

The 2010 Indiana Energy Conservation Code

and

The 2011 IES Illuminance Recommendations

November 29, 2011

presented by

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LC, LEED® AP, HFDP

sponsored by the

American Institute of Architects, Indiana Chapter

American Institute of Architects, Indianapolis Chapter

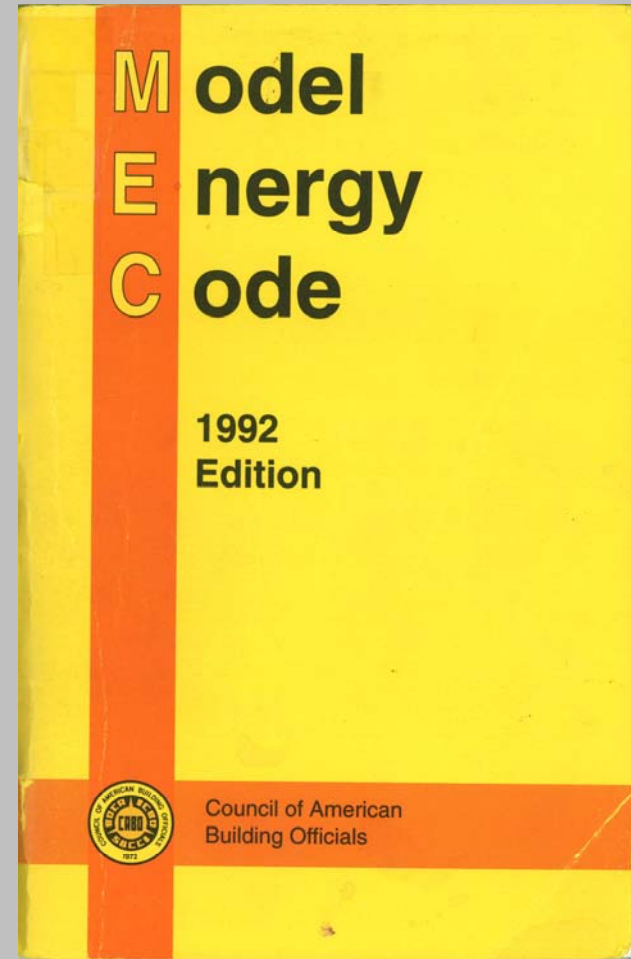
2010 Indiana Energy Conservation Code

- Does this look familiar?

It should because it was the Indiana Energy Code (with a few amendments) until May 6, 2010.

Much changed with the adoption of ASHRAE 90.1-2007 (with Indiana amendments) as the Indiana Energy Conservation Code, 2010 Edition. *The 31 addenda that ASHRAE has published for 90.1 over the years have NOT been adopted and are not in force in Indiana.*

*But before this, on 06.28.2008, Governor Daniels signed executive order 08-14 that requires all new State buildings to strive for the **goal** of improved energy efficiency, as demonstrated by LEED® Silver Certification, Energy Star Certification, or 2 Globes Certification under the Green Globes system (or the equivalent under another ANSI accredited system). Renovations are intended to follow similar guidelines.*



2010 Indiana Energy Conservation Code

Why me?

Not because I'm an Authority Having Jurisdiction or a Code Consultant; I'm neither.

But I am versatile and experienced--

1981 B.S.A.D. from M.I.T., Cambridge, Massachusetts

1984 M.Arch. from the University of Oregon, Eugene, Oregon

1985 Registered Architect, Indiana

2001 Professional Engineer, Indiana (and later in Illinois, Michigan and North Carolina)

2002 Lighting Certified by the National Council on Qualifications in the Lighting Professions

2006 LEED® AP by the United States Green Building Council

2008 HFDP (Healthcare Facility Design Professional by ASHRAE)

2009 Registered Interior Designer, Indiana

Vice President/General Manager, **JOHN OBERLIES CONSULTING ENGINEERS, INC.**, 10.1998

Part-time Instructor in Interior Design, **The Art Institute of IndianapolisSM**, 01.2008

Principal, SHurt lighting design, 03.2009

Author, Codes, Regulations, and Standards in Interior Design, Prentice Hall, 2011

2010 Indiana Energy Conservation Code

To explain this new regulation and its use for real projects, each of the following topics will be covered—

- **Applicability:** to which projects will this apply?
- **General Administrative Rules provisions**
- **History:** how did we get here? And why did this change?
- **Enforcement:** what did we have before and what will we have now?
- **Specific Requirements—**
 - Indiana Amendments*
 - Building Envelope*
 - HVAC*
 - Water Heating*
 - Power*
 - Lighting*
 - Other Equipment*
- **Compliance Reporting**
- **Summary**

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One- and Two-Family Dwellings (Class 2 structures)

Covered by the 2005 Indiana Residential Code (based on the 2003 International Residential Code), so no change at all here. *(New Chapter 11 - -- energy-- amendments pending.)* Townhouses not more than 3 stories high are classified as Class 1 structures.

All Class 1 structures (non-farm)

2008 Indiana Building Code (based on the 2006 International Building Code); **2010 Indiana Energy Conversation Code (based on ASHRAE 90.1-2007)**; 2008 Indiana Fire Code; 2009 Indiana Electrical Code; 2008 Indiana Mechanical Code; 2008 Indiana Fuel Gas Code, and 1999 Indiana Plumbing Code (But townhouses not more than 3 stories high are subject to the 2005 IRC, even though they are Class 1 structures.)

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GAR 12-4-12 Existing buildings; additions and alterations

“(b) Additions or alterations may be made... without requiring the entire existing building... to comply with all requirements...”

“(j) Alterations of buildings built prior to January 21, 1978 (the effective date of the first state rule for energy conservation) need not conform with the new construction requirements of 675 IAC 19.”

ASHRAE 90.1-2007 (with amendment language)

“4.1.1.3 Alterations of Existing Buildings. Alterations of existing buildings shall comply with the standard as described in Section 4.2 if a construction design release is required for the alterations.”

As of 08.26.2010, it has been confirmed that these provisions will be applied to new construction, additions, and alterations, although a gray area remains for buildings built prior to 01.21.1978. Much confusion remains, though.

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GAR 12-4-12 Existing buildings; additions and alterations

On 08.02.2011, the Commission adopted the following non-rule policy—

Indiana Register

FIRE PREVENTION AND BUILDING SAFETY COMMISSION

Interpretation by the Fire Prevention and Building Safety Commission

Title: Interpretation of [875 IAC 12-4-12\(j\)](#)

Date: August 2, 2011

Purpose: The purpose of this nonrule policy document is to clarify the application of the exemption from the requirements of the Indiana Energy Conservation Code, [875 IAC 19](#), contained in [875 IAC 12-4-12\(j\)](#). Subsection (j) provides as follows:

"(j) Alterations of buildings built prior to January 21, 1978 (the effective date of the first state rule for energy conservation) need not conform with the new construction standards of [875 IAC 19](#)."

Interpretation: The Commission has determined that [875 IAC 12-4-12\(j\)](#) is applicable regardless of whether the building or other Class 1 structure has undergone one or more changes of occupancy since its construction prior to January 21, 1978. The Commission also interprets [875 IAC 12-4-12\(j\)](#) to apply to all work done in the course of any alteration *[sic]* work done, regardless of the scope of the alteration work performed. For purposes of this interpretation, any remodeling work is deemed to be an alteration. The exemption contained in [875 IAC 12-4-12\(j\)](#) does not apply to any addition to a building or other Class 1 structure.

Posted: 08/10/2011 by Legislative Services Agency
An [html](#) version of this document.

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GAR 12-4-11 Change of Occupancy

On 10.04.2011, the Commission adopted the following non-rule policy—

Indiana Register

FIRE PREVENTION AND BUILDING SAFETY COMMISSION

Interpretation by
the Fire Prevention and Building Safety Commission

Title: Interpretation of [675 IAC 12-4-11\(b\)\(2\)\(B\)](#)

Date: October 4, 2011

Purpose: The purpose of this nonrule policy document is to clarify the application of [675 IAC 12-4-11\(b\)\(2\)\(B\)](#) to subsequent uses of a Class 1 structure. Subdivision (2)(B) provides as follows:

"(b) No change in the character or use of any building or structure shall be permitted that shall cause the building or structure to be classified within a different occupancy group or within a different division of the same occupancy group, unless the building or structure complies with, or is made to comply with the:

- (1) current rules of the commission for new construction for the proposed revised use of the building; or
- (2) provisions of:

(A) Chapter 34 of the Indiana Building Code ([675 IAC 13-2.5-32](#)); or

(B) [675 IAC 12-13](#).

Exception: Buildings constructed before the April 30, 1998, effective date of the 1998 Indiana Building Code ([675 IAC 13-2.3](#)) that change occupancy classification shall not be considered as a change in occupancy as outlined as follows:

Previous Classification	1998 IBC Classification
B-1	S-3
B-2	B, F-1, M, S-1, and S-2
B-3	S-4 and S-5
B-4	F-2 and S-2
Open Parking Garage	S-4
M	U"

Interpretation: The Commission has determined that any Class 1 structure that complied with the Commission's rules for a "previous classification" may be used for any of the occupancy classifications listed under the "1998 IBC Classification" directly opposite the "previous classification" in the chart in subdivision (2)(B), so long as the "previous classification" was the classification for which the Class 1 structure was originally constructed and all subsequent occupancy classifications have been within any of the occupancy classifications listed under the "1998 IBC Classification" directly opposite the "previous classification" in the chart in subdivision (2)(B). Any owner or occupant of a Class 1 structure for which an occupancy classification is changed in accordance with this interpretation shall provide written verification of the past occupancies of such Class 1 structure.

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- In 1992, the Federal government enacted the first Energy Policy Act. The July 2002 update of EPAct required all states to adopt state-wide energy codes at least as stringent as ASHRAE 90.1-1999 no later than July 2004, or risk losing federal funding.
- In January 2009, the Governor asked the State Building Commission to adopt a new energy code.
- The Fire Prevention and Building Safety Commission decided to adopt ASHRAE 90.1-2007 as the new Code (with amendments), in lieu of the more common 2006 International Energy Conservation Code. *This occurred because the Federal government told the State that it could not use the 2006 IECC or ASHRAE 90.1-2004 and it was too early to adopt the 2009 IECC.*
- Using ASHRAE 90.1-2007 brings Indiana fully up-to-date with other similar regulations.

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- Enforcement of the Indiana Energy Conservation Code, 1992 Edition, has been inconsistent or nonexistent in most cases.
- Enforcement of the IECC, 2010 edition, should be expected to be more stringent, especially because State Plan Review will require compliance documentation. Only time will tell which local jurisdictions are most aggressive in their enforcement.
(Since May 2010, the City of Indianapolis/Marion County has been issuing Notice of Review letters that include requirements for compliance reporting, even for projects that are clearly exempt under GAR 12-4-12 (j). Enforcement is the hot topic at the moment, and there is little clarity. A year and a half later, this has changed relatively little. Much confusion remains.)
- Few local authorities will have the technical expertise required to review compliance with these requirements to any significant degree of detail or with appropriate depth of understanding.

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The Indiana Amendments fall into two (2) broad categories: procedural and technical.

PROCEDURAL--

- **Not applicable to “*new systems and equipment in existing buildings*” 2.1a.3.**
- Not applicable to Two Family Dwellings (as opposed to “*multi-family structures of three stories or fewer...*”) 2.3a.
- Not applicable to manufacturing processes 2.3c
- Word meanings are as found in any unabridged American Standard English dictionary 3.1
- Approved means “...*as to materials, equipment, design, and types of construction, acceptance by the code official by one (1) of the following methods...*” 3.2
- “*Authority having jurisdiction*” and “*building official*” mean code official. 3.2
- “*Code official*” means “... *the division, the local building official as authorized under IC 36-7-2-9 and local ordinance or the fire department as authorized under IC 36-8-17-9.*” 3.2
- “*Labeled*” means “...*equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization engaged in product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.*” 3.2 (This definition is tighter than the definition in ASHRAE 90.1-2007.)

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PROCEDURAL— *(continued)*

- **Compliance is required for alterations to existing buildings where a construction design release is required. 4.1.1.3**
- The provisions for replacement of portions of existing buildings have been deleted. 4.1.1.4
- The provisions for changes in space conditioning have been deleted 4.1.1.5
- Administrative requirements are as defined in the GAR. 4.1.2
- Provisions for alternative materials, methods or construction or design are per the GAR. 4.1.3
- For alterations to existing buildings, only calculation methods approved by the division will be acceptable. 4.2.1.3
- Compliance documentation is to be as required by the GAR. 4.2.2
- All spaces are to be assumed to be conditioned in accordance with the GAR. 5.1.2.2
- **For projects requiring a design professional, compliance reports must be either ComCheck (or something similar that has been approved by the division), or a report from a comprehensive energy modeling program with an affidavit from the design professional. 5.7.1** *For projects requiring certification, the reports must be certified as well.*
- For projects not requiring a design professional, compliance reports must be either ComCheck (or something similar that has been approved by the division), or a report from a comprehensive energy modeling program with an affidavit from a design professional. 5.7.2

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TECHNICAL— *(these are selected key items; there are more)*

- **5 degree F. minimum deadbands are not required for special occupancies “...such as clean rooms, labs, museums, some areas of hospitals.” 6.4.1.3.2**
- Simultaneous humidification and de-humidification are not allowed (except certain desiccant systems). 6.4.3.7
- Duct sealing requirements for outside air ducts are the same as for return air ducts. 6.4.4.2A.
- Economizers are not required in specialty industrial/lab/hospital areas where strict air pressure controls are employed. 6.5.1
- The 2-pipe changeover outdoor air temperature dead band has been narrowed from 15 deg. F. to 4 deg. F. 6.5.2.2.2a
- Simultaneous heating and cooling of the same air stream is allowed for “specialty labs and clean rooms” as well as for computer rooms, museums, surgical suites, and buildings with refrigerating systems. 6.5.2.3d.

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TECHNICAL— *(these are selected key items; there are more)*

- Heat recovery is not required for exhaust air streams from specialty industrial/lab/hospital area where strict zone air pressure controls are employed. 6.5.6.1
- VAV control of lab room is not required if thermal or health and safety criteria mandate CV. 6.5.7.2a
- Outside air ducts are to be insulated like supply air ducts. Tables 6.8.2A and 6.8.2B
- **The lighting requirements do not apply to specialty lighting used in research areas that has material effects on test data or to specialty lighting required for high security video monitoring. 9.1.1**
- Tandem wiring requirements (no single lamp electromagnetic ballasts) do not apply to luminaires serving special lab or production areas requiring extraordinary light levels for quality assurance. 9.4.2g
- Exterior lighting requirement do not apply to lighting intended to highlight exterior features due to high security concerns. 9.4.5
- **Section 11 Energy Cost Budget Method has been eliminated in its entirety.**

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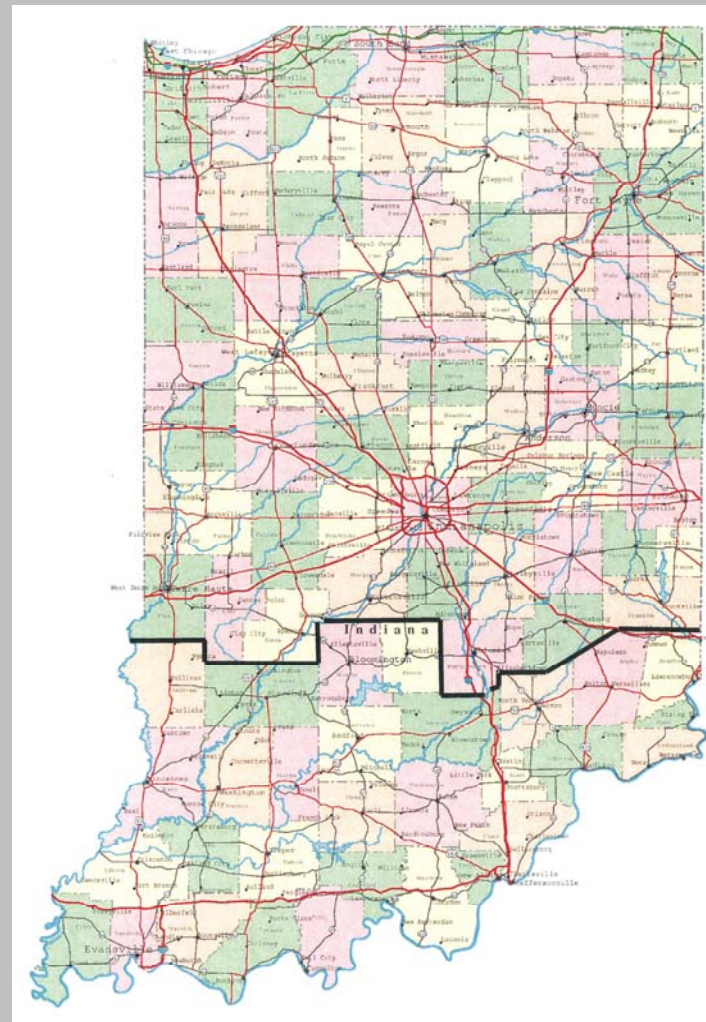
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- **Specific Requirements—**
Climate Zones

There are now two (2) climate zones:

5A for the bulk of the state
and

4A for 29 southern counties.



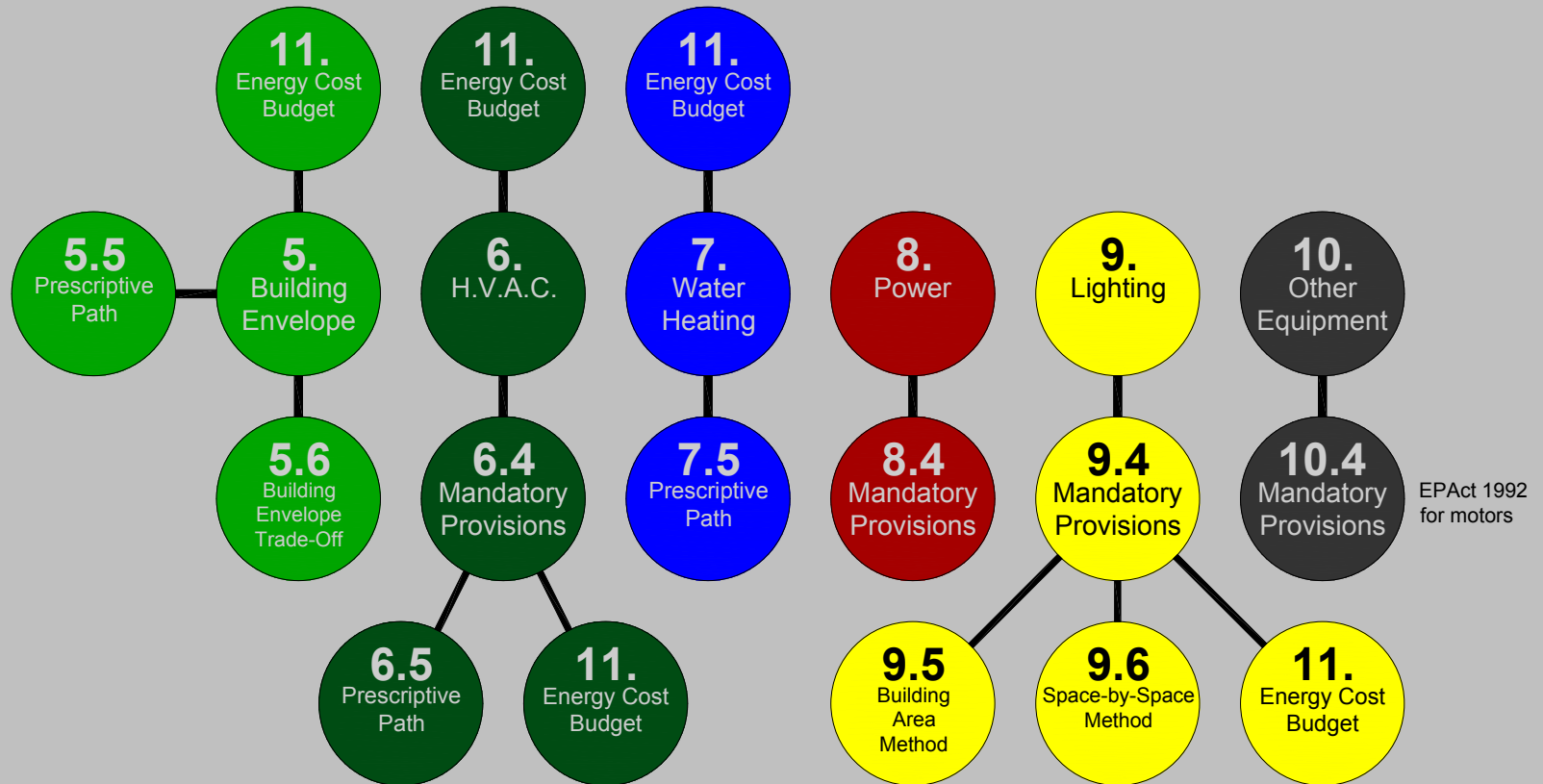
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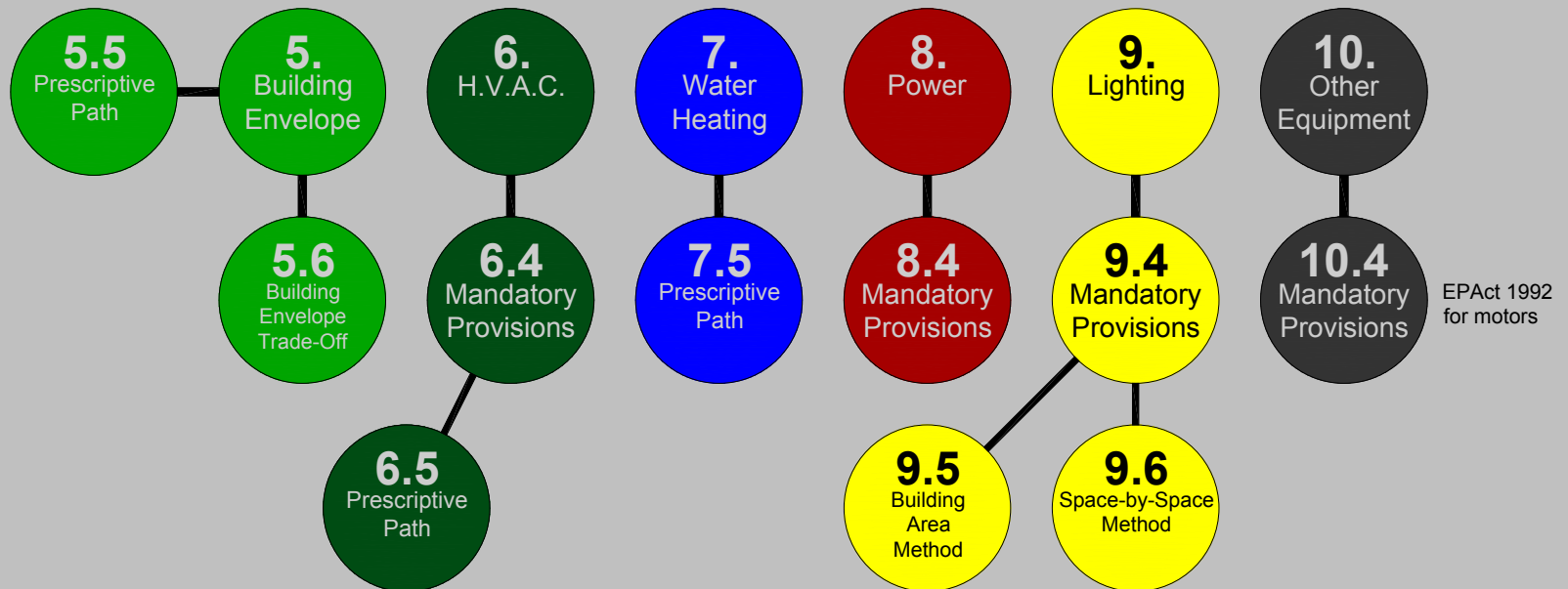
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- **Specific Requirements—**
Overall Organization



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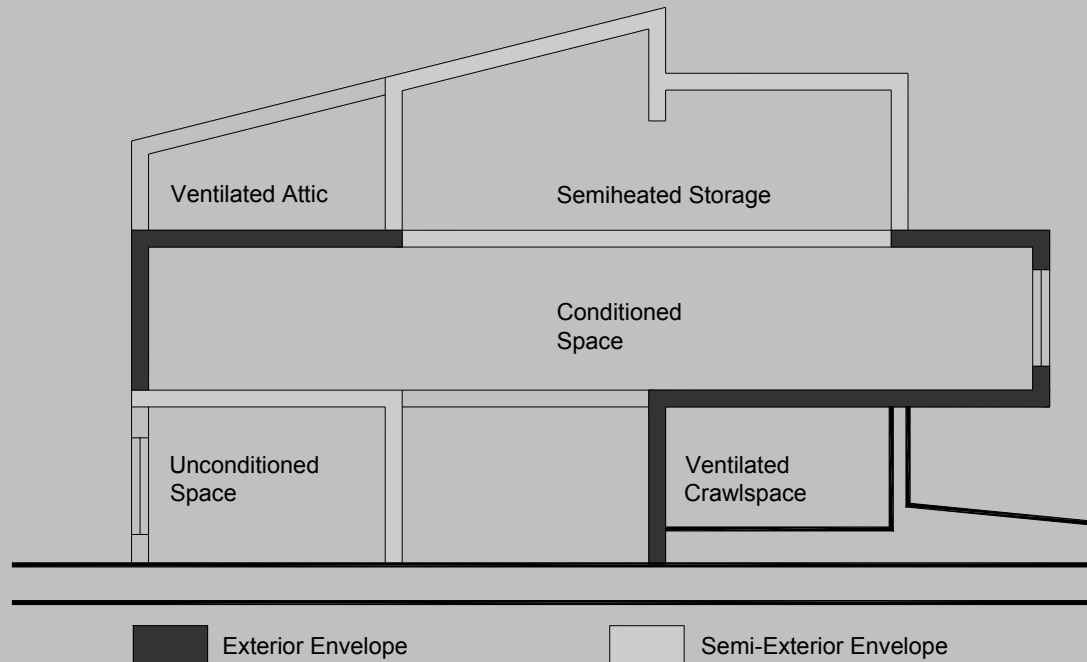
- **Specific Requirements—**
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There are three (3) **space conditioning categories**, with varying requirements—

- A. Nonresidential conditioned space
- B. Residential conditioned space
- C. Semi-heated space



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Envelope alterations are to comply with these requirements (*per ASHRAE 90.1-2007 but not for buildings built prior to 01.21.1978*), except—

- a. Installation of storm windows over existing glazing
- b. Replacement of glazing in existing sash and frame if U_o and SHGC values are not decreased
- c. Alterations to roof/ceiling, wall, or floor cavities already filled with insulation w/ $R \geq 3.0/\text{inch}$.
- d. Alternations to walls and floors where there are no framing cavities and new cavities are not created.
- e. Replacement of a roof membrane where either the sheathing or insulation is not exposed
- f. Replacement of existing exterior doors as long as a vestibule is not removed
- g. Replacement of existing fenestration up to 25% of the total area and as long as the U_o and SHGC values are not reduced

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There are three (3) methods for compliance in this area:

1. **5.5 Prescriptive Path**
2. **5.6 Building Envelope Trade-off Option**
3. *Section 11 Energy Cost Budget Method*

It should be noted that Section 11 Energy Cost Budget Method has been deleted in the Indiana Amendments, so it cannot be used. However, Appendix G Performance Rating Method has been retained. Performance Rating is used to evaluate the performance of designs that are intended to exceed the basic requirements.

Appendix G, Performance Rating Method, has been left in the Code and it is the intent of the Fire Prevention and Building Safety Commission to allow the use of this procedure in lieu of the Energy Cost Budget method in Section 11.

Each compliance path includes:

- 5.1 General
- 5.4 Mandatory Provisions
- 5.7 Submittals, and
- 5.8 Product Information and Installation Requirements.

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5.4 Mandatory Provisions

5.4.1 Insulation:

1. R-value clearly marked by the manufacturer 5.8.1.1
2. Installed in accordance with the manufacturer's instructions 5.8.1.2
3. Loose blown-in or poured insulation may not be used on slopes exceeding 3:12 5.8.1.3
4. Baffles are required at eave vents to move air above the insulation 5.8.1.4
5. Substantial contact is required between the insulation and the framing (except where the material relies on an air space for its performance) 5.8.1.5
6. **Recessed items (lights, HVAC, etc.) may not reduce the insulation thickness unless A) the affected area is less than 1% of the total area, B) the entire area is covered with full-depth insulation, or C) the effects of reduced thickness are accounted for in the calculations.** 5.8.1.6
7. Exterior insulation is to be covered to protect it from sun, moisture, landscaping operations, equipment maintenance, and wind. 5.8.1.7
8. Roof insulation may not be installed on lay-in ceiling panels. 5.8.1.8
9. Insulation is to cover the full component area. 5.8.1.9

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5.4 Mandatory Provisions *(continued)*

5.4.2 Fenestration and Doors:

1. U_o , SHGC, and air leakage rate is to be determined by a laboratory accredited by an entity like the National Fenestration Rating Council. 5.8.2.1
2. All fenestration products are to have permanent labels showing U_o , SHGC, and air leakage rate installed by the manufacturer (or separate certification). 5.8.2.2
3. All doors are to have permanent labels showing U_o and air leakage rate installed by the manufacturer (or separate certification). 5.8.2.3
4. U_o is to be determined by NFRC (National Fenestration Rating Council) 100, with skylights assumed to slope at 20 degrees. (There are four (4) detailed exceptions.) 5.8.2.4
5. SHGC is to be determined by NFRC 200. (There are four (4) detailed exceptions.)
6. Visible Lighting Transmittance (VLT) is to be determined by NFRC 200. 5.8.2.5

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5.4 Mandatory Provisions *(continued)*

5.4.3 Air-Leakage:

1. The following areas are to be sealed, caulked, gasketed, or weather-stripped to minimize air leakage—
 - a. Joints around fenestration and door frames
 - b. Junctions between walls and foundations, between walls at building corners, between walls and structural floors or roofs, and between walls and roof or wall panels.
 - c. Openings at penetrations of utility services through roofs, walls, and floors.
 - d. Site-built fenestration and doors.
 - e. Building assemblies used as ducts or plenums.
 - f. Joints, seams, and penetrations of vapor retarders.
 - g. All other openings in the building envelope. 5.4.3.1

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5.4 Mandatory Provisions *(continued)*

5.4.3 Air-Leakage:

2. Air leakage for fenestration and doors is to be determined in accordance with NFRC 400. 5.4.3.2
3. **Cargo and loading locks doors are required to have weatherseals in both climate zones. 5.4.3.3**
4. **Vestibules at least 7' deep are required at exterior entrances except for revolving doors, dwelling units, climate zone 4 (southern Indiana) for less than 4 stories and less than 10,000 sf, buildings in climate zone 5 (northern Indiana) that are less than 1,000 sf, and intermediate doors for spaces that are smaller than 3,000 sf. 5.4.3.4**

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5.5 Prescriptive Building Envelope Option

1. Opaque Areas: calculations are to be done per Appendix A (a detailed set of tables for many different construction types) using minimum R-values or by assembly U-factors, C-factors, or F-factors. (Required values are shown on Table 5.5-4 for Climate Zone 4A and on Table 5.5-5 for Climate Zone 5A)

5.5.3 Is spandrel glass fenestration or wall? If it is being used to respond to the maximum 40% fenestration requirement, then it is clearly not fenestration; but if it is wall, then the wall insulation requirements would apply, including continuous insulation in climate zone 5A (the c.i. insulation would be located behind the spandrel glass, of course).

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5.5 Prescriptive Building Envelope Option

2. Roof Areas: values per Tables 5.5-4 and 5.5-5 and skylight curbs are required to be insulated to $\geq R-5$. 5.5.3.1
3. High Albedo Roofs: Cool roofs– high reflectance and high emittance– are ***not applicable*** in Climate Zones 4A and 5A. 5.5.3.1.1 (*Such roofs are applicable in Climate Zones 1 – 3.*)
4. Above-grade Wall Insulation: values per Tables 5.5-4 and 5.5-5. If a wall is both above and below grade and the insulation is interior, then the entire wall it to be insulated according to the above grade requirements. If the insulation is exterior or integral, then the wall can be split in “above grade” and “below grade” portions. 5.5.3.2
5. Below-grade Wall Insulation: values per Tables 5.5-4 and 5.5-5. 5.5.3.3
6. Floor Insulation: values per Tables 5.5-4 and 5.5-5. 5.5.3.4

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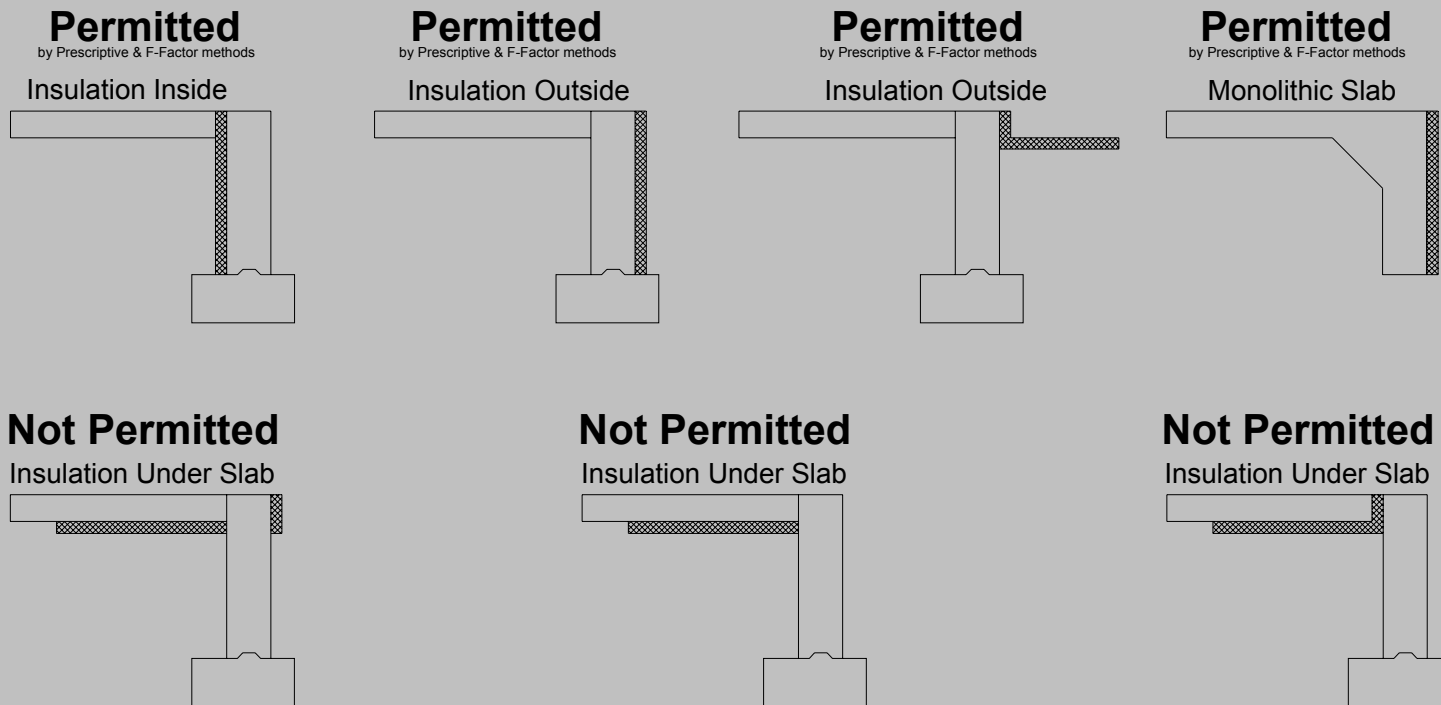
5.5 Prescriptive Building Envelope Option *(continued)*

Assembly	Non-Residential				Residential			
	4A		5A		4A		5A	
	Max U	Min R	Max U	Min R	Max U	Min R	Max U	Min R
Roofs								
Insulation Entirely Above Deck	0.048	20.0 c.i.	0.048	20.0 c.i.	0.048	20.0 c.i.	0.048	20.0 c.i.
Metal Building	0.065	19.0	0.065	19.0	0.065	19.0	0.065	19.0
Attic and Other	0.027	38.0	0.027	38.0	0.027	38.0	0.027	38.0
Walls, Above-Grade								
Mass	0.104	9.5 c.i.	0.090	11.4 c.i.	0.090	11.4 c.i.	0.080	13.3 c.i.
Metal Building	0.113	13.0	0.113	13.0	0.113	13.0	0.057	13.0 + 13.0
Steel-Framed	0.064	13.0 + 7.5 c.i.	0.064	13.0 + 7.5 c.i.	0.064	13.0 + 7.5 c.i.	0.064	13.0 + 7.5 c.i.
Wood-Framed and Other	0.089	13.0	0.064	13.0 + 3.8 c.i.	0.064	13.0 + 3.8 c.i.	0.051	13.0 + 7.5 c.i.
Walls, Below Grade								
Below-Grade Wall	C-1.140	NR	C-0.119	7.5 c.i.	C-0.119	7.5 c.i.	C-0.119	7.5 c.i.
Floors								
Mass	0.087	8.3 c.i.	0.074	10.4 c.i.	0.074	10.4 c.i.	0.064	12.5 c.i.
Steel-Joist	0.038	30.0	0.038	30.0	0.038	30.0	0.038	30.0
Wood-Framed and Other	0.033	30.0	0.033	30.0	0.033	30.0	0.033	30.0
Slab-on-Grade Floors								
Unheated	F-0.730	NR	F-0.730	NR	F-0.540	10 for 24"	F-0.540	10 for 24"
Heated	F-0.860	15 for 24"	F-0.860	15 for 24"	F-0.860	15 for 24"	F-0.860	15 for 24"
Opaque Doors								
Swinging	0.700		0.700		0.700		0.500	
Nonswinging	1.500		0.500		0.500		0.500	
Fenestration								
	Max U	Max SHGC	Max U	Max SHGC	Max U	Max SHGC	Max U	Max SHGC
Vertical Glazing, % of Wall								
Nonmetal framing (all)	0.40	0.40	0.35	0.40	0.40	0.40	0.35	0.40
Metal framing								
(curtainwall/storefront)	0.50	0.40	0.45	0.40	0.50	0.40	0.45	0.40
Metal framing (entrance door)	0.85	0.40	0.80	0.40	0.85	0.40	0.80	0.40
Metal framing (all other)	0.55	0.40	0.55	0.40	0.55	0.40	0.55	0.40
Skylight with Curb, Glass, % of Roof								
0% - 2.0%	1.17	0.49	1.17	0.49	0.98	0.36	0.49	1.98
2.1% - 5.0%	1.17	0.39	1.17	0.39	0.98	0.19	0.39	1.98
Skylight with Curb, Plastic, % of Roof								
0% - 2.0%	1.30	0.65	1.10	0.77	0.62	0.62	0.77	1.90
2.1% - 5.0%	1.30	0.34	1.10	0.62	0.27	0.27	0.62	1.90
Skylight without Curb, All, % of Roof								
0% - 2.0%	0.69	0.49	0.69	0.49	0.36	0.36	0.49	1.36
21.1% - 5.0%	0.69	0.39	0.69	0.39	0.19	0.19	0.39	1.36

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5.5 Prescriptive Building Envelope Option *(continued)*

7. Slab-on-grade Insulation: values per Tables 5.5-4 and 5.5-5. 5.5.3.5 *(The following illustration helps to explain the available options.)*



(even though this is not permitted under the Prescriptive requirements,
the F-Factors are provided on Table A6.3)

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5.5 Prescriptive Building Envelope Option *(continued)*

8. Opaque Doors: values per Tables 5.5-4 and 5.5-5. 5.5.3.6
9. Fenestration:
 - A. Where there are multiple assemblies, compliance is to be based on area weighted averages. 5.5.4.1
 - B. **The total vertical fenestration area is limited to 40% of gross wall area, unless shaded by partially opaque permanent projections (e.g. framing with glass or perforated metal) that will last as long as the building itself.** 5.5.4.2.1 *Is spandrel glass fenestration or wall? If it is being used to respond to the maximum 40% fenestration requirement, then it is clearly not fenestration; but if it is wall, then the wall insulation requirements would apply, including continuous insulation in climate zone 5A (the c.i. insulation would be located behind the spandrel glass, of course).*
 - C. **The 40% limited may be exceeded if using the Envelope Trade-off Option.**

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5.5 Prescriptive Building Envelope Option *(continued)*

8. Opaque Doors: values per Tables 5.5-4 and 5.5-5. 5.5.3.6
9. Fenestration:
 - D. Skylights are limited to 5% of the gross roof area, unless using the Envelope Trade-off Option. 5.5.4.2.3
 - E. **The minimum SHGC for vertical fenestration is determined by Tables 5.5-4 and 5.5-5.** 5.5.4.4.1
 - F. The minimum SHGC for skylights is determined by Tables 5.5-4 and 5.5-5. 5.5.4.4.2
 - G. The vertical glazing area limitation and SHGC do NOT apply to first floor street-side glazing (up to 20'-0" unless it's at an atrium and if there's a continuous overhang with a weighted Projection Factor (PF) > 0.5 and the total glazing does not exceed 75% of the street side elevation. 5.5.4.4.1c.

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5.4 Prescriptive Building Envelope Option *(continued)*

5.5.4.4.1 SHGC of Vertical Fenestration:

Only data from the National Fenestration Rating Council (NFRC) is acceptable. This data has not been verified for compliance, but most mfg's are NFRC members and their products should comply.

Glass Comparison: Climate Zone 5A, non-residential			
<i>all selections are 1" units consisting of two (2) 1/4" clear sheets of glass, one low-E coating, and a 1/2" air space, in storefront</i>			
Manufacturer	Product	Minimum Requirements U-value	SHGC
AGC	Clear Comfort E2	≤ 0.35	≤ 0.40
AGC	Clear Comfort Ti-PS	0.30	0.61
AGC	Clear Sunergy	0.38	0.59
AGC	Clear Comfort Ti-R	0.29	0.50
AGC	Clear Comfort Ti-AC 40	0.29	0.45
AGC	Clear Comfort Ti-AC	0.29	0.44
AGC	Clear Comfort Ti-AC 36	0.29	0.41
AGC	Clear Comfort Ti-AC 23	0.29	0.27
Cardinal	LoE-178	0.31	0.63
Cardinal	LoE-272	0.30	0.41
Cardinal	LoE-270	0.30	0.37
Cardinal	LoE-366	0.29	0.27
Cardinal	LoE-240	0.30	0.03
Guardian	SN 68	0.29	0.38
Guardian	SN 62	0.29	0.31
Guardian	SN 54	0.29	0.28
PPG	Sungate 500 (2) + Clear	0.35	0.62
PPG	Sungate 400 (2) Clear + Clear	0.32	0.60
PPG	Solarban 60 (2) Clear + Clear	0.29	0.38
PPG	Solarban 80 (2) Clear + Clear	0.29	0.24
Viracón	VNE 1-63	0.29	0.29
Viracón	VUE 13-50	0.29	0.27
Viracón	VNE 2-63	0.29	0.26
Viracón	VUE 15-50	0.29	0.26
Viracón	VNE 7-63	0.29	0.24
Viracón	VUE 6-50	0.29	0.23
Viracón	VNE 8-63	0.29	0.23
Viracón	VUE 2-50	0.29	0.22
Viracón	VNE 5-63	0.29	0.21
Viracón	VUE 8-50	0.29	0.20
Viracón	VNE 3-63	0.29	0.19
Viracón	VUE 3-50	0.29	0.17
Minimum Requirements		≤ 0.45	≤ 0.40

Glass Comparison: Climate Zone 4A, non-residential			
<i>all selections are 1" units consisting of two (2) 1/4" clear sheets of glass, one low-E coating, and a 1/2" air space, in storefront</i>			
Manufacturer	Product	Minimum Requirements U-value	SHGC
AGC	Clear Comfort E2	≤ 0.35	≤ 0.40
AGC	Clear Comfort Ti-PS	0.30	0.61
AGC	Clear Sunergy	0.38	0.59
AGC	Clear Comfort Ti-R	0.29	0.50
AGC	Clear Comfort Ti-AC 40	0.29	0.45
AGC	Clear Comfort Ti-AC	0.29	0.44
AGC	Clear Comfort Ti-AC 36	0.29	0.41
AGC	Clear Comfort Ti-AC 23	0.29	0.27
Cardinal	LoE-178	0.31	0.63
Cardinal	LoE-272	0.30	0.41
Cardinal	LoE-270	0.30	0.37
Cardinal	LoE-366	0.29	0.27
Cardinal	LoE-240	0.30	0.03
Guardian	SN 68	0.29	0.38
Guardian	SN 62	0.29	0.31
Guardian	SN 54	0.29	0.28
PPG	Sungate 500 (2) + Clear	0.35	0.62
PPG	Sungate 400 (2) Clear + Clear	0.32	0.60
PPG	Solarban 60 (2) Clear + Clear	0.29	0.38
PPG	Solarban 80 (2) Clear + Clear	0.29	0.24
Viracón	VNE 1-63	0.29	0.29
Viracón	VUE 13-50	0.29	0.27
Viracón	VNE 2-63	0.29	0.26
Viracón	VUE 15-50	0.29	0.26
Viracón	VNE 7-63	0.29	0.24
Viracón	VUE 6-50	0.29	0.23
Viracón	VNE 8-63	0.29	0.23
Viracón	VUE 2-50	0.29	0.22
Viracón	VNE 5-63	0.29	0.21
Viracón	VUE 8-50	0.29	0.20
Viracón	VNE 3-63	0.29	0.19
Viracón	VUE 3-50	0.29	0.17
Minimum Requirements		≤ 0.50	≤ 0.40

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5.5 Prescriptive Building Envelope Option *(continued)*

9. Fenestration: *(continued)*

- H. Visible Light Transmittance (VLT) is not regulated under the Prescriptive Building Envelope Option, but it is regulated under the Envelope Trade-off Option.
- I. Projection Factor is calculated by dividing the overhang projection by the distance from the window sill to the bottom of the overhang, and the PF reduces the SHGC as follows (additional adjustments are required for translucent overhangs):

PF	SHGC Multiplier (E,W,S)	SHGC Multiplier (N)
0 – 0.10	1.00	1.00
>0.10 – 0.20	0.91	0.95
>0.20 – 0.30	0.82	0.91
>0.30 – 0.40	0.74	0.87
>0.40 – 0.50	0.67	0.84
>0.50 – 0.60	0.61	0.81
>0.60 – 0.70	0.56	0.78
>0.70 – 0.80	0.51	0.76
>0.80 – 0.90	0.47	0.75
> 0.90 – 1.00	0.44	0.73

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5.5 Prescriptive Building Envelope Option *(continued)*

9. Fenestration: *(continued)*

- I. Average opacity of a translucent overhang is calculated using the following formula—

$$O_s = (A_i \times O_i) + (A_f \times O_f)$$

where O_s = average opacity

A_i = Percent of the infill

A_f = Percent of the framing

O_i = Opacity of the infill = 1.0 - solar transmittance

O_f = Opacity of the framing, usually 1.0 5.5.4.4.1

- J. Louvered overhangs qualify for credit if, and only if, they are designed to block all sun on the glazing at noon on June 21st.

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5.5 Prescriptive Building Envelope Option *(continued)*

9. Fenestration: *(continued)*

Shading examples—

Solid overhang: 3'-0" deep, 6" above a 5'-0" high window. The Projection Factor is $3'-0" / 5'-6" = 0.54$. The corresponding overhang multiplier (from Table 5.5.4.4.1) is 0.81 for north oriented openings and 0.61 for all other openings. If the NRFC SHGC of the glass is 0.6, the adjusted SHGC for north is $0.60 \times 0.81 = 0.49$, which fails the ≤ 0.40 requirement, and the adjusted SHGC for other orientations is $0.60 \times 0.61 = 0.37$, which meets the requirement.

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5.5 Prescriptive Building Envelope Option *(continued)*

9. Fenestration: *(continued)*

Shading examples—

Translucent overhang: 6'-0" deep, 12" above a 6'-0" high window, supported on 4" wide steel tubes at 48" o.c. with SHGC = 0.40. The PF = 6.0 / 7.0 = 0.86. The percent of opaque overhang is 4" / 48" = 0.083, or 8.3%, leaving 91.7% translucent. Solar transmission is given as 0.30, so opacity is

$$O_s = (0.917 \times (1.0 - 0.30)) + (0.083 \times 1.0) = 0.642 + 0.083 = 0.725$$

Adjusted projection factor is $0.725 \times 0.86 = 0.624$, so from Table 5.5.4.4.1, the multiplier is 0.56.

The adjusted SHGC = $0.40 \times 0.56 = 0.22$, more than meeting the requirement.

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5.6 Building Envelope Trade-off Option

1. The envelope performance factor must exceed that of the budget building. 5.6.1.b.
2. Tables 5.5-4 and 5.5-5 remain the basis of design for assemblies for the budget building, which is compared to the proposed design using a very elaborate, and complicated, procedure described in Appendix C. *(This procedure is so complex that it is best done with software. ASHRAE provides EnvStd software with the ASHRAE 90.1 User's Manual for this purpose. Essentially, the procedure requires separate calculations for each exterior element of the building— every individual wall or glazing surface, each roof plane, each skylight, etc.)*
3. The Building Envelope Trade-off Option must be used if vertical fenestration exceeds 40% of gross wall area or if skylights exceed 5% of gross roof area.

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5.6 Building Envelope Trade-off Option

4. **Minimum VLT (Visible Light Transmittance) requirements apply to fenestration, even if there is no plan for day-lighting. The assumption built into the standard is that a future decision could be made to incorporate day-lighting and that the permanent glazing must be built to accommodate that possibility.**
5. Trade-offs can be done only between envelope components and not between lighting and the envelope or between HVAC and the envelope (or between lighting and HVAC for that matter).

A detailed explanation of EnvStd specifically, or this process in general, is beyond the scope of this short presentation.

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To explain this new regulation and its use for real projects, each of the following topics will be covered—

- **Applicability:** to which projects will this apply?
- **General Administrative Rules provisions**
- **History:** how did we get here? And why did this change?
- **Enforcement:** what did we have before and what will we have now?
- **Specific Requirements—**
 - Indiana Amendments*
 - Climate Zones*
 - Building Envelope*
 - HVAC*
 - Water Heating*
 - Power*
 - Lighting*
 - Other Equipment*
- **Compliance Reporting**
- **Summary**

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6. HVAC

Two (2) compliance paths are available—

Simplified Approach

and

Mandatory Provisions and Prescriptive Path

(Remember that the Energy Cost Budget Method was eliminated in the Amendments)

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6. HVAC

6.3 Simplified Approach

1. Useable only for ≤ 2 stories and $< 25,000$ sf per system.

ASHRAE has a unique definition for building: “a structure wholly or partially enclosed within exterior walls, or within exterior and party walls, and a roof...” This means that tenant spaces are buildings under the Energy Code. So the Simplified Approach can be used for HVAC if the individual tenants are smaller than 25,000 sf and automatic lighting controls are not required for tenants that are less than 5,000 sf (see 9.4 to follow).

2. Each system must be single zone.
3. An air-side economizer is required for all units $\geq 65,000$ Btuh in Climate Zone 5A.
4. Air-side economizers can be eliminated in Climate Zone 4A by increasing EER from 9.0 to 10.9 without gas heat or to 10.7 with gas heat.
5. Minimum equipment efficiencies are shown on the next four (4) slides-

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6.3 Simplified Approach *(continued)*

Split-system or RTU DX Air-conditioners:

Equipment capacity	SEER
$\leq 65,000$ Btuh	> 13.0
$> 65,000$ Btuh $< 135,000$ Btuh	> 11.2 with electric resistance heat or no heat
$> 65,000$ Btuh $< 135,000$ Btuh	> 11.0 with gas heat
$\geq 135,000$ Btuh $< 240,000$ Btuh	> 11.0 with electric resistance heat or no heat
$\geq 135,000$ Btuh $< 240,000$ Btuh	> 10.8 with gas heat

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6.3 Simplified Approach *(continued)*

Heat Pumps:

Equipment capacity

$\leq 65,000$ Btuh

$> 65,000$ Btuh $< 135,000$ Btuh

$> 65,000$ Btuh $< 135,000$ Btuh

$\geq 135,000$ Btuh $< 240,000$ Btuh

$\geq 135,000$ Btuh $< 240,000$ Btuh

EER

> 12.1

> 11.5 with electric resistance
heat or no heat

> 11.3 with gas heat

> 11.0 with electric resistance
heat or no heat

> 10.8 with gas heat

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6.3 Simplified Approach *(continued)*

Packaged Terminal Air Conditioner (PTAC):

$$\text{EER} \geq 12.5 - (0.213 \times \text{Cap}/1,000)$$

example— for a 12,000 Btuh unit, $\text{EER} \geq 12.5 - (0.213 \times 12,000/1,000) = 12.5 - (0.213 \times 12) = 12.5 - (2.6) = 9.9$

Packaged Terminal Heat Pump (PTHP):

$$\text{Cooling EER} \geq 12.3 - (0.213 \times \text{Cap}/1,000)$$

$$\text{Heating COP} \geq 3.2 - (0.026 \times \text{Cap}/1,000)$$

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6.3 Simplified Approach *(continued)*

Single Package Vertical Air Conditioner (SPVAC):

$\leq 65,000$ Btuh	EER ≥ 9.0
$> 65,000$ Btuh $< 135,000$ Btuh	EER ≥ 8.9
$> 65,000$ Btuh $< 135,000$ Btuh	EER ≥ 8.6

Single Package Vertical Heat Pump (SPVHP):

$\leq 65,000$ Btuh	EER ≥ 9.0	COP ≥ 3.0
$> 65,000$ Btuh $< 135,000$ Btuh	EER ≥ 8.9	COP ≥ 3.0
$> 65,000$ Btuh $< 135,000$ Btuh	EER ≥ 8.6	COP ≥ 2.9

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6.3 Simplified Approach *(continued)*

6. Maximum outside air intake is 3,000 cfm and 70% of the total air-flow. *(Mechanical engineers are generally uncomfortable running commodity equipment, whether split-system or RTU, at OA volumes greater than 15%, and even that is questionable in some circumstances.)*
7. A manual changeover or dual-setpoint thermostat is required for each system.
8. For air-to-air heat pumps, auxiliary heat can only be used when the heat pump cannot meet the load.
9. Simultaneous heating and cooling is prohibited.

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6.3 Simplified Approach *(continued)*

10. Units in hotel rooms having a capacity of < 15,000 Btuh and a fan smaller than $\frac{3}{4}$ hp are exempt.
11. Refrigerant piping where the temperature is < 40° F. is required to have $\frac{1}{2}$ " thick insulation for piping smaller than 1" and 1" insulation for piping up to 4". Exterior piping is required to be protected.
12. Ductwork and plenums are required to be insulated, sealed, and balanced. Insulation requirements follow on the next slide-

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6.3 Simplified Approach *(continued)*

12. Ductwork insulation requirements—

	Climate Zone 4A	Climate Zone 5A
Unventilated attic		R-1.9
Unconditioned space	R-3.5	R-3.5
Exterior/ventilated attic/ unventilated attic w/ insul.	R-6.0	R-6.0

13. If heating and cooling are separate, there must be an interlock to prevent simultaneous operation.
14. Gravity or motorized dampers are required for exhaust fans > 300 cfm.

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6.4 Mandatory Provisions

1. Minimum equipment efficiencies are the same as for the Simplified Approach.
2. Each zone must have a separate thermostat (a dwelling unit can be considered one zone).
3. Perimeter heating for exterior envelope loads only may serve multiple zones if there is a thermostat for each exposure (> 50 lf) and if a thermostat is located in one of the zones served.
4. Thermostats must have deadbands of at least 5° F., unless they are manual changeover or unless the facility is a special use (retirement homes, process applications, museums, some areas of hospitals).
5. If heating and cooling are separate, with separate thermostats, there can be no overlap.

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6.4 Mandatory Provisions

6. HVAC systems are required to have automatic shut-down (except where capacity is $< 15,000$ Btuh and a manual on/off switch is provided), using one (1) of the following methods—
 - A. Different 7-day schedules, if the system can maintain programming for 10 hours in the event of a power failure and with an accessible manual over-ride switch for up to 2 hours.
 - B. Occupant sensor for up to 30 minutes.
 - C. Manual timer for up to 2 hours.
 - D. Interlock to security system to shut-off the system when the security system is activated.

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6.4 Mandatory Provisions *(continued)*

7. In Climate Zones 4A and 5A, heating systems are required to have automatic setback to 55° F. or lower. 6.4.3.3.2
8. Heating and cooling air systems of $\geq 10,000$ cfm capacity are required to have optimum start controls, based on space temperature, occupancy setpoint, and the amount of time prior to scheduled occupancy. 6.4.3.3.3
9. Isolation zones are required for systems serving non-simultaneously occupied zones. 6.4.3.3.4
10. **Stair and shaft vents are required to have motorized dampers to close them, except under a fire alarm signal.**
6.4.3.4.1

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6.4 Mandatory Provisions *(continued)*

11. Gravity hoods, vents, and ventilators are to have motorized dampers to close them when not in use (except in buildings of ≤ 3 stories). 6.4.3.4.2
12. Shut-off dampers are required at outside air intake and exhaust air discharge openings when not in use and for outside air intakes during pre-occupancy warm-up, cool-down, and setback, unless ventilation is used to reduce energy consumption (e.g. night purge) or if ventilation is required by Code. *(Exceptions include gravity dampers in buildings that are ≤ 3 stories and gravity dampers for outside air and exhaust that are ≤ 300 cfm.)* 6.4.3.4.4
13. Maximum damper leakage rates are to be per AMCA Standard 500. 6.4.3.4.4
14. Ventilation fans > 0.75 hp are to have automatic shut-off when not required. 6.4.3.4.5

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6.4 Mandatory Provisions *(continued)*

15. Heat pump auxiliary heat is to operate only when the heat pump cannot meet the load. 6.4.3.5
16. Simultaneous humidification and de-humidification is not permitted (except systems using desiccant in series with direct evaporative cooling). 6.4.3.7
17. Freeze protection systems (e.g. heat tracing) are to shut-off automatically when the outdoor temperature is $> 40^{\circ}$ F.; snow and ice melt systems are to be shut-off automatically when the pavement temperature is $> 50^{\circ}$ F. and when there is no precipitation (or by automatic or manual control when outdoor air temperature is $> 40^{\circ}$ F.). 6.4.3.8

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6.4 Mandatory Provisions *(continued)*

18. Demand Control Ventilation (i.e. variable ventilation based on occupancy) is required for areas > 500 sf having an occupant load of > 40 occupants/1,000 sf (i.e. 1 occupant/25 sf– so classrooms, un-concentrated assembly, and concentrated assembly) if using an air-side economizer, an automatically modulating outside air damper, or if the design outdoor air-flow is > 3,000 cfm. 6.4.3.9
19. Duct insulation requirements are shown on the following slide--

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6.4 Mandatory Provisions *(continued)* Tables 6.8.2A and 6.8.2B

These are increased requirements. Typical 1.5" thick (0.75 PCF, 1.0 PCF and 1.5 PCF) fiberglass blankets provide R-4.8 installed, or less. So it will be necessary to use 2" thick blankets at 1.5 PCF and 1.0 PCF or 2 3/16" thick blankets at 0.75 PCF to achieve R-6.0 as required for heating and cooling SA and OA ducts.

Minimum Duct Insulation	Zone 4A	Zone 5A
	Min R	Min R
Heating and Cooling		
Supply & outside air: exterior	R-6	R-6
Supply & outside air: ventilated attic	R-6	R-6
Supply & outside air: unvented attic above insulated ceiling	R-6	R-6
Supply & outside air: unvented attic with roof insulation	R-3.5	R-1.9
Supply & outside air: unconditioned space	R-3.5	R-3.5
Supply & outside air: buried	R-3.5	R-3.5
Return air: exterior	R-3.5	R-3.5
Return air: ventilated attic	R-3.5	R-3.5
Return air: unvented attic above insulated ceiling	R-3.5	R-3.5
Return air: unvented attic with roof insulation	NR	NR
Return air: unconditioned space	NR	NR
Return air: buried	NR	NR
Heating Only		
Supply & outside air: exterior	R-6	R-6
Supply & outside air: ventilated attic	NR	R-3.5
Supply & outside air: unvented attic above insulated ceiling	NR	NR
Supply & outside air: unvented attic with roof insulation	NR	NR
Supply & outside air: unconditioned space	NR	NR
Supply & outside air: buried	NR	R-3.5
Return air: exterior	R-3.5	R-3.5
Return air: ventilated attic	R-3.5	R-3.5
Return air: unventilated attic over insulated ceiling	R-3.5	R-3.5
Return air: unventilated attic with insulated room	NR	NR
Return air: unconditioned space	NR	NR
Return air: buried	NR	NR
Cooling and Outside Air Only		
Supply & outside air: exterior	R-3.5	R-3.5
Supply & outside air: ventilated attic	R-3.5	R-1.9
Supply & outside air: unvented attic above insulated ceiling	R-6	R-3.5
Supply & outside air: unvented attic with roof insulation	R-1.9	R-1.9
Supply & outside air: unconditioned space	R-1.9	R-1.9
Supply & outside air: buried	NR	NR
Return air: exterior	R-3.5	R-3.5
Return air: ventilated attic	R-3.5	R-3.5
Return air: unventilated attic over insulated ceiling	R-3.5	R-3.5
Return air: unventilated attic with insulated room	NR	NR
Return air: unconditioned space	NR	NR
Return air: buried	NR	NR

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6.4 Mandatory Provisions *(continued)*

20. Minimum piping insulation thickness requirements are as follows—
Table 6.8.3

Pipe size	< 1"	1" -1 ½ "	1 ½" – 4"	4" – 8"
Heating hot water (141 – 200° F.)	1.0"	1.0"	1.0"	1.5"
Heating hot water (105 – 140° F.)	0.5"	0.5"	1.0"	1.0"
Domestic hot water (105° F. +)	0.5"	0.5"	1.0"	1.0"
Chilled water (40 – 60° F.)	0.5"	0.5	1.0"	1.0"
Chilled water (< 40° F.)	0.5"	1.0"	1.0"	1.0"

except-- factory insulated equipment, fluid between 60 -105° F., not heated or cooled fluids (e.g. roof and condensate drains, domestic cold water (still recommended to reduce condensation), natural gas, refrigerant liquid, etc.), heating hot water for up to 4'-0" between a valve and coil if in conditioned space, and unions in heating hot water and steam systems.

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6.4 Mandatory Provisions *(continued)*

21. Minimum duct sealing (class) requirements are as follows—
Table 6.4.4.2A

Duct Location	Supply		Duct Type	
	$\leq 2''$ w.c.	$> 2''$ w.c.	Exhaust	Return/Outside Air
Outdoor	A	A	C	A
Unconditioned	B	A	C	B
Conditioned	C	B	B	C

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6.5 Prescriptive Path

1. **Air-side, or water-side, economizers are required for all cooling systems with capacity of $\geq 135,000$ Btuh in Climate Zone 5A. Economizers are NOT required in Climate Zone 4A. 6.5.1.1**
2. Mixed-air temperature only may NOT be used to control economizer dampers for single zone systems. 6.5.1.1.2
3. Air-side economizers are to be capable of automatically reducing outside air intake if increased outside air intake will not reduce energy use. 6.5.1.1.3

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6.5 Prescriptive Path

4. Relief venting is required when using air-side economizers to prevent over-pressurization. 6.5.1.1.5
5. Air-side economizer controls are to be capable of partial economizer cooling in conjunction with partial mechanical cooling, except DX systems to prevent frosting, DX units having a capacity of < 65,000 Btuh, and in Climate Zones 1, 2, 3A, **4A**, **5A**, 5B, 6, 7, and 8. 6.5.1.3 *(It should be noted that the exceptions cover ALL projects in Indiana.)*

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6.5 Prescriptive Path *(continued)*

6. Zone controls are to prevent re-heating, re-cooling, mixing of previously heated and previously cooled air, and other simultaneous heating and cooling, except for—

- a. Zones where the volume of re-heated, re-cooled, or mixed air is no greater than the larger of:
 1. The volume of outside required to meet ASHRAE 62.1 for the zone.
 2. 0.4 cfm/sf of the zone area.
 3. 30% of the peak supply rate.
 4. 300 cfm (if the zone is $\leq 10\%$ of the overall system).
 5. Any higher rate accepted by the AHJ.
- b. Zones where constant volume is required by special pressurization relationships (e.g. licensed healthcare or some laboratories), cross-contamination requirements (e.g. laboratories), or minimum circulation rates (e.g. licensed healthcare and some laboratories).
- c. Zones where at least 75% of the energy used for re-heating or to provide warm air for mixing is provided from a site-recovered or solar energy source. 6.5.2.1

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6.5 Prescriptive Path *(continued)*

7. Re-heating and re-cooling of fluids in hydronic systems are also prohibited. 6.5.2.2
8. 3-pipe common return systems are prohibited out-right.
6.5.2.2.1
9. 2-pipe changeover systems are acceptable if the deadband for changeover is $\geq 4^{\circ}\text{F}$. outside air temperature, the system operates in a mode for at least 4 hours, and if reset controls are used to allow for $\leq 30^{\circ}\text{F}$. difference between heating and cooling temperatures at the changeover point.
6.5.2.2.2

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6.5 Prescriptive Path *(continued)*

10. For closed-loop water-source heat pump systems, the deadband for the loop is to be $\geq 20^{\circ}$ F. and, for winter protection, a bypass loop or a low-leakage positive closure damper is provided if using a fluid cooler; a bypass loop is provided if using an open tower; or shut-down of the tower loop is provided if using an open tower in combination with a heat exchanger. 6.5.2.2.3

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6.5 Prescriptive Path *(continued)*

11. Where humidistatic controls are provided (for either humidification or de-humidification), such controls are to prevent re-heating, mixing of hot and cold air, or other simultaneous heating and cooling, with numerous exceptions—

- a. If air-flow is reduced to $\leq 50\%$ of design.
- b. If the cooling unit capacity is $\leq 80,000$ Btuh and it is capable of unloading to $\geq 50\%$.
- c. If the cooling unit capacity is $\leq 40,000$ Btuh.
- d. Systems serving spaces where humidity control is required (e.g. computer rooms, museums, surgical suites, *specialty labs and clean rooms*, supermarkets, refrigerated warehouses, and ice arenas).
- e. Where at least 75% of the energy for re-heating or for providing warm air for mixing is provided from a site-recovered or site-solar source.
- f. Where the heat added is from a desiccant system and at least 75% of the heat added by the desiccant is removed by heat exchanger. 6.5.2.3

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6.5 Prescriptive Path *(continued)*

12. Systems using hydronic cooling AND humidification are required to use water-side economizers. 6.5.2.4
13. Systems having fans larger than 5 hp are subject to power limits. *(The details of this are beyond the scope of this presentation.)* 6.5.3
14. Variable Air Volume (VAV) fans ≥ 10 hp are required to meet the following—
 - a. Driven by a mechanical or an electrical variable speed drive,
 - b. Be a vane-axial fan with variable pitch blades, or
 - c. Have other controls to result in $\leq 30\%$ of design wattage at 50% of design air volume at 1/3 total design static pressure.6.5.3.2.1

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6.5 Prescriptive Path *(continued)*

15. Hydronic pumps larger than 10 hp are required to meet the following--

- a. Variable flow down to 50% or more of design flow rate.
- b. Individual pumps > 50 hp having > 100 feet of head are required to have controls to results in $\leq 30\%$ of design wattage at 50% of design water flow.

except for systems having total pump hp ≤ 75 hp and systems having 3 or fewer control valves. 6.5.4.1

16. If multiple chillers or boilers are used, the controls are to be capable of reducing flow rates if one (1) chiller or boiler is shut down. 6.5.4.2

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6.5 Prescriptive Path *(continued)*

17. Supply water temperature re-set is required for chilled water and hot water systems having a capacity of more than 300,000 Btuh, either using return water temperature or outdoor temperature. 6.5.4.3
18. Heat rejection fans (e.g. air-cooled condensers, open towers, evaporative coolers, dry coolers, etc.) ≥ 7.5 hp are to be capable of operating at $2/3$ or less of full speed with automatic controls to vary fan speed according to leaving fluid temperature. 6.5.5.2

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6.5 Prescriptive Path *(continued)*

19. Exhaust air energy recovery fans $\geq 5,000$ cfm and where outside air supply is $\geq 70\%$ of design supply air quantity must have at least 50% energy recovery effectiveness, with numerous exceptions—
 - a. Laboratory systems.
 - b. Systems serving space with heat only to less than 60o F.
 - c. Systems exhausting toxic, flammable, paint, or corrosive fumes or dust.
 - d. Type I (grease extracting and fire suppressing) hoods in commercial kitchens.
 - e. If $> 60\%$ of outdoor air heating energy is from a site-recovered or site-solar source.
 - f. Where the largest exhaust source is $< 75\%$ of design outdoor airflow.
 - g. Systems requiring de-humidification that use energy recovery in series with a cooling coil. 6.5.6.1
20. Condenser heat recovery systems are required for some large systems ($> 1,000,000$ Btuh is water heating load, 24/7 operation, and $> 6,000,000$ Btuh heat rejection capacity). 6.5.6.2

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6.5 Prescriptive Path *(continued)*

21. Individual kitchen hoods having fans larger than 5,000 cfm are required to be provided with makeup air for at least 50%, where the makeup air is unheated or heated to no more than 60° F, except where air would otherwise exfiltrate or where certified grease extractor hoods require a face velocity no greater than 60 fpm. 6.5.7
22. Buildings having fume hood systems greater than 15,000 cfm are to include at least one of the following features—
 - a. VAV systems capable of reducing exhaust and makeup volume to 50% or less.
 - b. Where thermal or health and safety criteria require constant volume.
 - c. If direct makeup air is at least 75% of the exhaust rate, heated to no warmer than 2° F. below room setpoint or cooled to no more than 3° F. above room setpoint, and there is no simultaneous heating and cooling for de-humidification. 6.5.7.2

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To explain this new regulation and its use for real projects, each of the following topics will be covered—

- **Applicability:** to which projects will this apply?
- **General Administrative Rules provisions**
- **History:** how did we get here? And why did this change?
- **Enforcement:** what did we have before and what will we have now?
- **Specific Requirements—**
 - Indiana Amendments*
 - Climate Zones*
 - Building Envelope*
 - HVAC*
 - Water Heating*
 - Power*
 - Lighting*
 - Other Equipment*
- **Compliance Reporting**
- **Summary**

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7 Service Water Heating

There is only one compliance path for service (domestic) water heating, which is to follow the Mandatory Provisions and the Prescriptive Path.

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7.4 Mandatory Provisions

1. Load calculations are to be done in accordance with manufacturers' published sizing guidelines or by generally accepted engineering practice. *(The Indiana amendments struck the suggestion to use the ASHRAE Handbook – HVAC Applications.)* 7.4.1
2. Minimum efficiencies for water heaters are given in Energy Factor and Thermal Efficiency on Table 7.8. Most commercial products meet these requirements, so compliance should not be difficult.
3. Hot water piping (i.e. supply, recirc, first 8'-0" of outlet piping of a non-recirc storage system, the inlet piping between a storage tank and heat trap in a non-recirc system, and heat traced piping) is to be insulated, as follows— 7.4.3

Piping Size	< 1"	1" – 1 ½"	1 ½" – 4"	4" – 8"
> 105° F.	0.5"	0.5"	1.0"	1.0"

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7.4 Mandatory Provisions *(continued)*

4. Controls for heat tracing and recirculation are to be equipped with automatic time switches or other controls to turn off the systems during extended periods when hot water is not needed. 7.4.4.2
5. **The maximum hot water delivery temperature at lavatory faucets in public facility restrooms is 110° F. 7.4.4.3**
6. Readily accessible on/off switches are required for pool heaters, and continuously burning pilot lights are prohibited for natural gas burning heaters. 7.4.5.1

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7.4 Mandatory Provisions *(continued)*

7. Heated pools are required to have vapor-retardant covers on or at the water surface. Pools heated to more than 90° F. are required to have insulated ($\geq R-12$) covers. Covers are not required if $> 60\%$ of the energy for heating is from a site-recovered or solar energy source. 7.4.5.2
8. Time switches are required at pool heaters and pumps unless public health standards require 24/7 circulation or where pumps are required operate solar and waste heat recovery systems. 7.4.5.3
9. Heat traps (to counteract natural convection of heater water in a vertical pipe) are required for vertical pipe risers at storage heaters and tanks in a non-recirculating system. 7.4.6

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7.5 Prescriptive Path

1. Combination space heating and water heating systems are allowed if the standby loss does not exceed $(13.3 \times pmd + 400)/n$ (where *pmd* is probably minimum demand in gph and *n* is the fraction of the year where daily mean temperature exceeds 64.9° F.) and where the energy input is less than 150,000 Btuh. 7.5.1

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To explain this new regulation and its use for real projects, each of the following topics will be covered—

- **Applicability:** to which projects will this apply?
- **General Administrative Rules provisions**
- **History:** how did we get here? And why did this change?
- **Enforcement:** what did we have before and what will we have now?
- **Specific Requirements—**
 - Indiana Amendments*
 - Climate Zones*
 - Building Envelope*
 - HVAC*
 - Water Heating*
 - Power*
 - Lighting*
 - Other Equipment*
- **Compliance Reporting**
- **Summary**

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8 Power

There is only one compliance path for power, which is to follow the Mandatory Provisions.

8.4 Mandatory Provisions

1. Voltage drop may not exceed 2% in feeders. 8.4.1.1
2. Voltage drop may not exceed 3% in branch circuits. 8.4.1.2

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To explain this new regulation and its use for real projects, each of the following topics will be covered—

- **Applicability:** to which projects will this apply?
- **General Administrative Rules provisions**
- **History:** how did we get here? And why did this change?
- **Enforcement:** what did we have before and what will we have now?
- **Specific Requirements—**
 - Indiana Amendments*
 - Climate Zones*
 - Building Envelope*
 - HVAC*
 - Water Heating*
 - Power*
 - Lighting*
 - Other Equipment*
- **Compliance Reporting**
- **Summary**

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9 Lighting

There are two (2) compliance paths for lighting, starting with the Mandatory Provisions for both of them. After the Mandatory Provisions, either the Building Area Method or the Space-by-Space Method may be used.

These requirements apply to interior spaces, exterior building features, and exterior building grounds, except for emergency lighting that is normally off, lighting within dwelling units, lighting that is required by a health or life safety statute, decorative gas lighting systems, *specialty lighting used in research areas that has material effects on test data, and specialty lighting required for high security video monitoring.* 9.1.1

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9 Lighting

These requirements apply to replacement in existing facilities and all new lighting systems, except where replacement is less than 50% of the existing luminaires. 9.1.2 *Clarification: all added lighting must comply; replacement lighting must comply only where it constitutes more than 50% of existing. For partial renovation projects, how is the 50% threshold determined? No one really seems to know.*

Installed interior lighting power is to include all power used by luminaires, including lamps, ballasts, transformers, drivers, control devices, etc. (There is an important exception for parallel systems where the controls prevent simultaneous operation; in such a case, only the system with the highest wattage has to be counted.) 9.1.3

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9 Lighting *(continued)*

Luminaire wattage is to be determined by one of the following methods—

- a. Maximum labeled wattage of the fixture for incandescent or tungsten-halogen. *(If the socket is labeled “150 watt maximum”, the luminaire has to be counted as 150 watts no matter what size lamp is installed.)*
- b. For ballasts and transformers, the input wattage is determined by the manufacturer.
- c. For line voltage track and plug-in busway, the specified wattage or 30 W/lf (whichever is greater), or the wattage limit of the system’s circuit breaker, or the wattage limit of another current limiting device. *(This is a lower requirement than the NEC’s 75 W/lf; without this lower requirement, it would be very difficult to use track lighting at all. Current limiting devices are now standard options from most manufacturers in order to take advantage of this method.)* 9.1.4

There are numerous exclusions from the lighting power requirements, which are shown on the next two (2) slides--

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9 Lighting *(continued)*

- a. Essential display or accent lighting in a gallery, museum, or at a monument.
- b. Integral lighting within a piece of equipment.
- c. Medical or dental procedure lighting.
- d. Integral lighting with refrigerators or freezers.
- e. Lighting for food warming or within food preparation equipment.
- f. Lighting for plant growth or maintenance.
- g. Lighting for special needs occupants, including those with visual impairment or other medical or age-related issues.

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9 Lighting *(continued)*

- h. Lighting in retail display windows (only in enclosed windows).
- i. Lighting within historic landmark buildings.
- j. Integral lighting within advertising or directional signage.
- k. Exit signs.
- l. Lighting for sale or for educational demonstration purposes.
- m. Lighting for theatrical purposes.
- n. Lighting for television broadcasting of sporting events.
- o. Casino gaming areas.
- p. Furniture-mounted supplemental task lighting with automatic shut-off.

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9.4 Mandatory Provisions

1. In buildings large than 5,000 sf, interior lighting is to be controlled with an automatic control device to shut off in all spaces. This can be done by using
 - a centralized system with a schedule (to control individual areas no larger than 25,000 sf or one floor),
 - occupant sensor(s) to turn off within 30 minutes of the occupant(s) leaving, or
 - from a signal from another control or alarm system (BAS, DDC, etc.)

There are exceptions for

- a. Lighting intended for 24/7 operation.
- b. Lighting in patient care areas.
- c. Lighting in spaces where automatic shut-off would endanger the safety or security of the room or occupant(s). 9.4.1.1

Note that tenant spaces qualify as “buildings” under ASHRAE.

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9.4 Mandatory Provisions

2. Each space enclosed by ceiling height partitions is required to have at least one control device for that space. The device must be readily accessible, and it must turn off the lights automatically within 30 minutes of the occupant(s) leaving (see 1. above) except in classrooms (K – 12), conference/meeting rooms, and employee lunch and break rooms. In other spaces, the device is to be manual or automatic, controlling no more than 2,500 sf (within a space of 10,000 sf or less) or 10,000 sf (within a space that's larger than 10,000 sf). The device must have a manual over-ride for up to 4 hours. 9.4.1.2 *(This does mean that an open office of 9,000 sf would be required to have four (4) control devices, while an open office of 11,000 sf would only be required to have two (2) control devices.)*

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9.4 Mandatory Provisions *(continued)*

3. For exterior lighting, automatic controls are required for either dusk-to-dawn operation (i.e. photosensor only) or for photosensor on/timeswitch off operation (i.e. a combination of a photosensor and a timeswitch). Such controls are required to retain their programming for up to 10 hours during a power loss. *(There is an exception for covered vehicle entrances or exits from buildings or parking structures where required for safety, security, or eye adaptation.)* 9.4.1.3
4. Additional controls are required as follows—
 - a. Display/Accent lighting: separate
 - b. Case lighting: separate
 - c. Hotel and Motel guest room lighting: master control at the room entrance for all permanent luminaires and switched receptacles.

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9.4 Mandatory Provisions *(continued)*

4. Additional controls are required as follows—
 - d. Task lighting: separate via integral or wall mounted device
 - e. Nonvisual lighting for plant growth or food warming: separate
 - f. Demonstration lighting: separate 9.4.1.4
5. Tandem wiring is prohibited for electromagnetic ballasts for lamps greater than 30 w each, except where recessed luminaires are more than 10'-0" apart, for non-continuous surface or pendant mounted luminaires, luminaires that use single lamp electronic ballasts, luminaires using 3-lamp ballasts, luminaires on emergency circuits, and luminaires with no available pair. 9.4.2

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9.4 Mandatory Provisions *(continued)*

6. The maximum wattage for exit signs is 5 w per face. 9.4.3
(This will not affect any LED exit signs, all of which use far less than 5 w per face. But it will prevent the use of the T1 cold cathode exit sign.)
7. Exterior luminaires using more than 100 watts must use lamps having efficacy of at least 60 lumens/watt, unless the luminaire is controlled by a motion sensor. 9.4.4 *(This simply prohibits the use of incandescent lamps greater than 100 watts outside without motion sensors. It could also conceivably eliminate some LED products, but that is unlikely because few such products would reach the 100 watt threshold.)*
8. For exterior building lighting, the total power allowance includes the amounts given on Table 9.4.5 PLUS a 5% general allowance. Trade-offs are limited per the requirements of Table 9.4.5. 9.4.5

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9.4 Mandatory Provisions *(continued)*

9. If separately controlled, the following applications are exempt from the exterior power allowance—
 - a. Specialized signal, directional, and marker lighting associated with transportation.
 - b. Advertising signage or directional signage.
 - c. Lighting integral to equipment.
 - d. Lighting for theatrical purposes.
 - e. Lighting for athletic playing areas.
 - f. Temporary lighting.
 - g. Lighting for industrial production, material handling, etc.
 - h. Theme elements in amusement parks. 9.4.5

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9.5 Building Area Method

1. Determine the Lighting Power Density (LPD) from Table 9.5.1—
 - 0.3 w/sf Parking garage
 - 0.7 w/sf Multifamily
 - 0.8 w/sf Warehouse
 - 0.9 w/sf Automotive facility
 - 1.0 w/sf Dormitory, Exercise Center, Hotel, Motel, Office, Penitentiary, Police/fire Station, Transportation
 - 1.1 w/sf Gymnasium, Museum, Post Office, Sports Arena, Town Hall
 - 1.2 w/sf Convention Center, Courthouse, Hospital, Motion Picture Theater, School/university
 - 1.3 w/sf Dining: bar lounge/leisure, Library, Manufacturing Facility, Religious building
 - 1.4 w/sf Dining: cafeteria/fast food, Workshop
 - 1.5 w/sf Retail
 - 1.6 w/sf Dining: family, Performing arts theater

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9.5 Building Area Method *(continued)*

It must be pointed out that these numbers are considerably lower than what has been used commonly in projects in Indiana. A typical 10'-0" x 12'-0" private office with two (2) 2' x 4' deep parabolic troffers with 3 – F32T8 lamps would use about 1.75 w/sf, or about 175% of the new allowance. It will be necessary to use either A) lower lighting levels, B) more efficient luminaires, or C) a combination of both to make this work. Unusual ceiling heights make this even more challenging. That 10' x 12' office would have a room cavity ratio (RCR) of 5.5 with a ceiling at 8'-6"; raising the ceiling to 10'-0" would increase the RCR to 6.9, which would reduce the light level by roughly 7%.

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9.5 Building Area Method *(continued)*

2. Multiply the gross area of the building by the LPD. If there is more than one Building Area Type in the building, calculate each one separately and add them up to get a total. Trade-offs are allowed between types, as long as the total is not exceeded. 9.5.1

For example, take a 3-story building (20,000 sf per floor) with retail on the ground level and offices on the upper two (2) levels. The total LPD would be—

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9.5 Building Area Method *(continued)*

20,000 sf x 1.5 (for the retail floor) + 2 x 20,000 sf x 1.0 (for the office floors) =

30,000 watts + 40,000 watts = 70,000 watts

And it would be allowable to use 30,000 watts for the offices so as to be able to use 40,000 watts in the retail space, or some other similar trade-off arrangement, as long as the total does not exceed 70,000 watts.

It is important to note that these figures include lamps, ballasts, driver, transformers, and control devices, so it is vital to determine power factors and to verify actual power draw for drivers, transformers, and control devices.

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9.6 Space-by-Space Method

1. Determine the Lighting Power Density (LPD) allowances from Table 9.6.1. 9.6.1

This method is considerably more complex, because each space is treated separately. Table 9.6.1 is more than a full page, and it includes LPD's from 0.2 w/sf (for Atrium— Each Additional Floor) to 3.3 w/sf (Performing Arts Theater). The methodology is the same as in the previous example, but it's necessary to review recommended illuminance levels first. ASHRAE says to use "IES Recommendations" for illuminance levels. The 9th edition of the IES Handbook, published in 2000, included 7 categories; the 10th edition, published earlier this year, includes 25 categories, plus 3 "age ranges" for a total of 75 options. This major change is little understood at this time.

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9.5 Space-by-Space Method

Light Reflectance Values (LRV) are also key. Lighting calculations assume that the ceiling is 80% reflective, that the walls are 50% reflective (on average), and that the floor is 20% reflective. If darker, or lighter, colors are used, it is important for the lighting designer to know so that adjustments can be made in the calculations.

The table at the right shows the footcandle recommendations from the IESNA's 2000 Lighting Handbook (Ninth Edition). The Tenth Edition recommendations are summarized and compared on the following two slides. Needless to say this requires much explanation.

Figure 10-9. Determination of Illuminance Categories*

Orientation and simple visual tasks. Visual performance is largely unimportant. These tasks are found in public spaces where reading and visual inspection are only occasionally performed. Higher levels are recommended for tasks where visual performance is occasionally important.

A	Public spaces	30 lx (3 fc)
B	Simple orientation for short visits	50 lx (5 fc)
C	Working spaces where simple visual tasks are performed	100 lx (10 fc)

Common visual tasks. Visual performance is important. These tasks are found in commercial, industrial and residential applications. Recommended illuminance levels differ because of the characteristics of the visual task being illuminated. Higher levels are recommended for visual tasks with critical elements of low contrast or small size.

D	Performance of visual tasks of high contrast and large size	300 lx (30 fc)
E	Performance of visual tasks of high contrast and small size, or visual tasks of low contrast and large size	500 lx (50 fc)
F	Performance of visual tasks of low contrast and small size	1000 lx (100 fc)

Special visual tasks. Visual performance is of critical importance. These tasks are very specialized, including those with very small or very low contrast critical elements. Recommended illuminance levels should be achieved with supplementary task lighting. Higher recommended levels are often achieved by moving the light source closer to the task.

G	Performance of visual tasks near threshold	3000 to 10,000 lx (300 to 1000 fc)
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* Expected accuracy in illuminance calculations are given in Chapter 9, Lighting Calculations. To account for both uncertainty in photometric measurements and uncertainty in space reflections, measured illuminances should be with $\pm 10\%$ of the recommended value. It should be noted, however, that the final illuminance may deviate from these recommended values due to other lighting design criteria.

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9.5 Space-by-Space Method *(continued)*

Obviously, this approach is far more complex, requiring subtle distinctions between similar activities and requirements. Additional sections in the Handbook must be referenced to determine which category to use in any given situation.

Framework | Perceptions and Performance

Table 4.1 | Recommended Illuminance Targets

Category	Recommended Illuminance Targets (lux)			Some Typical Application and Task Characteristics	Visual Performance Description	
	Visual Ages of Observers (years) where at least half are					
	<25	25 to 65	>65			
Interior and exterior applications	A	0.5	1	2	• Dark-adapted situations • Basic convenience situations • Very-low-activity situations	Orientation, relatively large-scale, physical (less cognitive) tasks Visual performance is typically not work-related, but related to dark sedentary social situations, senses of safety and security, and casual circulation based on landscape, hardscape, architecture, and people as visual tasks.
	B	1	2	4		
	C	2	4	8	• Slow-paced situations • Low-density situations	
	D	3	6	12	• Slow-to-moderate-paced situations • Moderate-to-high-density situations	
	E	4	8	16		
	F	5	10	20	• Moderate-to-fast-paced situations • High-density situations	
	G	7.5	15	30	• Some indoor very subdued circulation situations • Some indoor social situations	
	H	10	20	40		
Interior and exterior applications	I	15	30	60	• Congested and significant outdoor intersections, important decision points, gathering places, and key points of interest • Some indoor social situations • Some indoor commerce situations	Common social activity and large and/or high-contrast tasks Visual performance involves higher-level assessment of landscapes, hardscape, architecture, and people and can be work-related.
	J	20	40	80		
	K	25	50	100		
	L	37.5	75	150	• Some outdoor commerce situations • Some indoor social situations • Some indoor commerce situations	
	M	50	100	200		
	N	75	150	300		
	O	100	200	400		
	P	150	300	600	• Some indoor social situations • Some indoor education situations • Some indoor commerce situations • Some indoor sports situations	
Interior and exterior applications	Q	200	400	800		Common, relatively small-scale, more cognitive or fast-performance visual tasks Visual performance is typically daily life- and work-related, including much reading and writing of hardcopies and electronic media consecutively and/or simultaneously.
	R	250	500	1000	• Some indoor education situations • Some indoor commerce situations • Some indoor sports situations • Some indoor industrial situations	
	S	375	750	1500		
	T	500	1000	2000		
	U	750	1500	3000	• Some sports situations • Some indoor commerce situations • Some indoor industrial situations	
	V	1000	2000	4000		
	W	1500	3000	6000	• Some sports situations • Some indoor industrial situations • Some healthcare procedural situations	
	X	2500	5000	10000		
Interior applications	Y	5000	10000	20000	• Some healthcare procedural situations	Unusual, extremely minute and/or life-sustaining cognitive tasks Visual performance is of the highest order in respective fields of health care, industrial, and sports.

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9.5 Space-by-Space Method *(continued)*

IES - The Lighting Handbook

9th Edition Category	10th Edition Category	10th Edition Description	Recommended Illuminance						
			age < 25		age 25 to 65		age > 65		
			lux	footcandle	lux	footcandle	lux	footcandle	
	A	Orientation: very low activity	0.5	0.0	1.0	0.1	2.0	0.2	Mostly Exterior
	B	Orientation: very low activity	1.0	0.1	2.0	0.2	4.0	0.4	
	C	Orientation: slow-paced	2.0	0.2	4.0	0.4	8.0	0.7	
	D	Orientation: slow-to-moderate	4.0	0.4	6.0	0.6	12.0	1.1	
	E	Orientation: slow-to-moderate	5.0	0.5	8.0	0.7	16.0	1.5	
	F	Orientation: moderate to fast	7.5	0.7	10.0	0.9	20.0	1.9	
	G	Orientation: moderate to fast	10.0	0.9	15.0	1.4	30.0	2.8	
	H	Orientation: moderate to fast	15.0	1.4	20.0	1.9	40.0	3.7	
A	I	Congested outdoor; indoor social	20.0	1.9	30.0	2.8	60.0	5.6	E/I
	J	Outdoor commerce; indoor commerce/social	25.0	2.3	40.0	3.7	80.0	7.4	Mostly Interior
B	K	Outdoor commerce; indoor commerce/social	25.0	2.3	50.0	4.6	100.0	9.3	
	L	Outdoor commerce; indoor commerce/social	37.5	3.5	75.0	7.0	150.0	13.9	
C	M	Outdoor commerce; indoor commerce/social	50.0	4.6	100.0	9.3	200.0	18.6	
	N	Outdoor commerce; indoor commerce/social	75.0	7.0	150.0	13.9	300.0	27.9	
	O	Outdoor commerce; indoor commerce/social	100.0	9.3	200.0	18.6	400.0	37.2	
D	P	Social, education, commerce, sports	150.0	13.9	300.0	27.9	600.0	55.7	
	Q	Education, commerce, sports, industrial	200.0	18.6	400.0	37.2	800.0	74.3	
E	R	Education, commerce, sports, industrial	250.0	23.2	500.0	46.5	1,000.0	92.9	
	S	Education, commerce, sports, industrial	375.0	34.8	750.0	69.7	1,500.0	139.4	
F	T	Sports, commerce, industrial	500.0	46.5	1,000.0	92.9	2,000.0	185.8	
	U	Sports, commerce, industrial	750.0	69.7	1,500.0	139.4	3,000.0	278.7	
	V	Sports, commerce, industrial	1,000.0	92.9	2,000.0	185.8	4,000.0	371.6	
G	W	Sports, industrial, healthcare procedural	1,500.0	139.4	3,000.0	278.7	6,000.0	557.4	Interior Only
G	X	Healthcare procedural	2,500.0	232.3	5,000.0	464.5	10,000.0	929.0	
G	Y	Healthcare procedural	5,000.0	464.5	10,000.0	929.0	20,000.0	1,858.0	

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9.5 Space-by-Space Method *(continued)*

There are two (2) major changes between 2000 and 2011—

1. There are now 25 illuminance categories instead of 7, and they span the range of 0.5 – 20,000 lux (0.05 – 1,858 fc). **1.0 fc = 10.764 lux**

The IES setup these categories by dividing the range from 1 – 10,000 lux into 25 steps, each of which is roughly 30% higher than the previous step. It's worth noting that some of the categories bear little differentiation between them, e.g. L, M, and N, all of which are listed with the same visual performance description and with the same typical applications and task characteristics.

2. There are now 3 age categories: < 25, 25 to 65, and > 65

The levels in the “low” category are half of the levels in the mid category, and the levels in the “high” category are double the levels in the mid category, which also means that the levels in the high category are four times the levels in the low category. The handbook suggests applying these categories according to occupancy, and the category that's used should represent 50% or more of the occupants in a given situation.

More on this after we wrap up the application of LPD's under the 2010 IECC.

2010 Indiana Energy Conservation Code

9.6 Space-by-Space Method

First Floor

17,000 sf of retail sales area x 1.7 w/sf = 28,900 watts

3,000 sf of retail storage x 0.8 w/sf = 2,400 watts

Second Floor

15,000 sf of enclosed offices x 1.1 w/sf = 16,500 watts

4,000 sf of conference x 1.3 w/sf = 5,200 watts

500 sf of restrooms x 0.9 w/sf = 450 watts

500 sf of electrical/mechanical x 1.5 w/sf = 750 watts

Third Floor

16,000 sf of open offices x 1.1 w/sf = 17,600 watts

3,000 sf of conference x 1.3 w/sf = 3,900 watts

500 sf of restrooms x 0.9 w/sf = 450 watts

500 sf of electrical/mechanical x 1.5 w/sf = 750 watts

Total Power Allowance 76,900 watts (70,000 watts)

(So for this example, Space-by-Space is the better option.)

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9.6 Space-by-Space Method *(continued)*

2. Additional lighting power is allowed under the Space-by-Space method, as follows—
 - a. Decorative lighting (including chandeliers, sconces, art lighting) up to an additional 1.0 w/sf.
 - b. For retail highlighting, as follows—

Additional = 1,000 watts + (Retail Area 1 x 1.0 w/sf) + (Retail Area 2 x 1.7 w/sf) + (Retail Area 3 x 2.6 w/sf) + (Retail Area 4 x 4.2 w/sf).

where Retail Area 1 is the total floor area, not including areas 2, 3, and 4; Retail Area 2 is the area of vehicles, sporting goods, and small electronics; Retail Area 3 is the area of furniture, clothing, cosmetics, and artwork, and Retail Area 4 is the area of jewelry, crystal, and china.

(Other merchandise can be included in Areas 2 and 4 if justification is provided and approved by the AHJ.) 9.6.2

2010 Indiana Energy Conservation Code

9.6 Space-by-Space Method *(continued)*

In the previous example, this simply makes it even clearer that the space-by-space method should be used because these additional amounts are not available in the Building Area Method.

Also, luminaire efficiencies matter much more now than they have in the past. Luminaires that appear to be equal, may not be equal if they use lower power factor ballasts or if they are simply less efficient.

Now, back to the illuminance recommendations--

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9.5 Space-by-Space Method *(continued)*

The major challenge here is finding a way to meet increased illuminance levels (at least in some situations) while complying with the LPD limitations in the 2010 IECC. Here's an example for the conference room we're in (see handouts)—

SHurt lighting design

7421 north audubon road indianapolis, in 46250 317.361.2277

Illuminance verses Wattage Comparison

Layout	Room	Fixture Type	Lamps	number of fixtures	fc avg	watts	w/sf	rough cost	IECC Compliant
1	Conference	Lensed 2 x4	4-F32T8	11	86.2	1232	1.6	\$1,100.00	N
2	Conference	Lensed 2 x4	4-F40T12	11	96.9	1815	2.4	\$1,100.00	N
3	Conference	Lensed 2 x4	4-F32T8	8	61.4	896	1.2	\$800.00	Y
4	Conference	Lensed 2 x4	4-F40T12	5	46.1	825	1.1	\$500.00	Y
5	Conference	3" Deep Parabolic	3-F32T8	11	62.8	965	1.3	\$1,400.00	Y
6	Conference	RT5	2-F28T5	14	73.8	948	1.2	\$2,650.00	Y
7	Conference	HPR-LED	LED	16	67.2	954	1.3	\$4,500.00	Y
8	Conference	RT5	2-F28T5	7	30.5	417	0.5	\$1,325.00	Y
9	Conference	HPR-LED	LED	7	38.1	474	0.6	\$2,000.00	Y

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9.5 Space-by-Space Method *(continued)*

Here are examples for a typical 10' x 12' private office and a 25' x 60' open office (see handouts)—

SHurt lighting design

7421 north audubon road indianapolis, in 46250 317.361.2277

Illuminance versus Wattage Comparison

Layout	Room	Fixture Type	Lamps	number of fixtures	fc avg	watts	w/sf	rough cost	IECC Compliant
10	Office	Lensed 2 x4	3-F32T8	1	31.7	88	0.7	\$100.00	Y
11	Office	3" deep Parabolic	3-F32T8	1	30.7	87.7	0.7	\$120.00	Y
12	Office	RT5	2-F28T5	2	39.2	119.2	1.0	\$340.00	Y
13	Office	HPR-LED	LED	1	27.2	67.7	0.6	\$275.00	Y
14	Open Office	Lensed 2 x4	3-F32T8	18	48.1	1584	1.1	\$1,800.00	Y
15	Open Office	3" deep Parabolic	3-F32T8	18	46.3	1578.6	1.1	\$2,160.00	Y
16	Open Office	RT5	2-F28T5	27	51.6	1609.2	1.1	\$4,590.00	Y
17	Open Office	HPR-LED	LED	24	53.7	1624.8	1.1	\$8,600.00	Y

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9.5 Space-by-Space Method *(continued)*

What categories does the IES suggest for private offices, open offices, and meeting rooms?

The 9th edition says:

“Reading”— category D (30 fc) or E (50 fc) for most tasks

Open plan office with intensive VDT use— category D

“Meeting”— category D

The 10th edition says:

“Reading” 8- and 10-point type— category P (27.9/55.7 fc)

Reading with VDT screen— category L (7/13.9 fc), N (13.9/27.9 fc),
or P

Conference— category P

2010 Indiana Energy Conservation Code

9.5 Space-by-Space Method *(continued)*

When does the IES suggest using higher categories?

Category R (46.5/92.9 fc)

- reading of handwritten work in red pencil, analog facsimile or xerograph, or 6-point font
- for IT equipment service
- in armories, identification processing, and retail in correctional facilities
- on evidence tables, attorneys tables, baliff station, and bench in courtrooms
- in schools on science lab benches, for physical education and in the field house
- in health care for ambulatory care general and over-bed, for procedures, and in workrooms
- in medium manufacturing and for general laboratory work

Category S (69.7/139.4 fc)–

- dental suite recovery
- radio pharmacy in nuclear medicine
- pharmacy controlled substances vault, receiving and storage, assignment and preparation

and some even higher categories for specialized and/or very small work in industry, health care, education, etc.

2010 Indiana Energy Conservation Code

To explain this new regulation and its use for real projects, each of the following topics will be covered—

- **Applicability:** to which projects will this apply?
- **General Administrative Rules provisions**
- **History:** how did we get here? And why did this change?
- **Enforcement:** what did we have before and what will we have now?
- **Specific Requirements—**
 - Indiana Amendments*
 - Climate Zones*
 - Building Envelope*
 - HVAC*
 - Water Heating*
 - Power*
 - Lighting*
 - Other Equipment*
- **Compliance Reporting**
- **Summary**

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10 Other Equipment

There is only one compliance path for power, which is to follow the Mandatory Provisions.

10.4 Mandatory Provisions

1. Electric Motors are to comply with EPAAct 1992. 10.4.1

2010 Indiana Energy Conservation Code

To explain this new regulation and its use for real projects, each of the following topics will be covered—

- **Applicability:** to which projects will this apply?
- **General Administrative Rules provisions**
- **History:** how did we get here? And why did this change?
- **Enforcement:** what did we have before and what will we have now?
- **Specific Requirements—**
 - Indiana Amendments*
 - Climate Zones*
 - Building Envelope*
 - HVAC*
 - Water Heating*
 - Power*
 - Lighting*
 - Other Equipment*
- **Compliance Reporting**
- **Summary**

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Compliance Reporting

The Indiana Amendments allow for the following compliance reports—

- A. ComCheck report (signed and sealed by the design professional for projects that require certification)
- B. Other prescriptive compliance software or other methods approved by the Division (either signed and sealed by the design professional or with an affidavit signed and sealed by the design professional) for projects that require certification.
- C. Report from a comprehensive energy modeling program with an affidavit signed and sealed by the design professional for projects that require certification.

In practice, ComCheck reports are probably easier and faster to do for most projects. The following slides show a typical report--

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Compliance Reporting (continued)



COMcheck Software Version 3.8.0

Envelope Compliance Certificate

90.1 (2007) Standard

Section 1: Project Information

Project Type: **New Construction**

Project Title:

Construction Site:

Owner/Agent:

Designer/Contractor:

Section 2: General Information

Building Location (for weather data):

Climate Zone:

Building Type for Envelope Requirements:
Vertical Glazing / Wall Area Pct:

5a
Non-Residential
5%

Building Type:

Automotive Facility

Floor Area

8587

Section 3: Requirements Checklist

Envelope PASSES: Design 1% better than code.

Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor(s)
Sales Exterior Walls: Concrete Block 12", Unreinforced, Cells Insulated, Normal Density, Furring: Metal	3020	3.0	13.0	0.051	0.090
Sales Windows: Metal Frame Double Pane with Low-E, Clear, SHGC 0.30	324	---	---	0.300	0.550
Garage Walls: Concrete Block 12", Unreinforced, Cells Insulated, Normal Density, Furring: None	4068	---	0.0	0.210	0.090
Service Walls: Concrete Block 12", Unreinforced, Cells Insulated, Normal Density, Furring: Metal	712	3.0	13.0	0.051	0.090
Service Windows: Metal Frame Double Pane with Low-E, Clear, SHGC 0.30	40	---	---	0.300	0.550
Sales Roof: Insulation Entirely Above Deck	2378	---	38.0	0.026	0.048
Garage Roof: Insulation Entirely Above Deck	5230	---	38.0	0.026	0.048
Service Roof: Insulation Entirely Above Deck	962	---	38.0	0.026	0.048
Sales Floor: Slab-On-Grade Unheated, Horizontal with vertical 3 ft.	2378	---	7.0	---	---
Garage Floor: Slab-On-Grade Unheated, Horizontal with vertical 3 ft.	5230	---	7.0	---	---
Service Floor: Slab-On-Grade Unheated, Horizontal with vertical 3 ft.	962	---	7.0	---	---

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

Insulation:

- ☒ 1. Open-blown or poured loose-fill insulation has not been used in attic roof spaces with ceiling slope greater than 3 in 12.
- ☒ 2. Wherever vents occur, they are baffled to deflect incoming air above the insulation.
- ☒ 3. Recessed lights, equipment and ducts are not affecting insulation thickness.

Project Title:
Data filename:

Report date: 08/12/10
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- ☒ 4. No roof insulation is installed on a suspended ceiling with removable ceiling panels.
- ☒ 5. All exterior insulation is covered with protective material.
- ☒ 6. Cargo and loading dock doors are equipped with weather seals.

Fenestration and Doors:

- ☒ 7. Windows and skylights are labeled and certified by the manufacturer for U-factor and SHGC.
- ☒ 8. Fixed windows and skylights unlabeled by the manufacturer have been site labeled using the default U-factor and SHGC.
- ☒ 9. Other unlabeled vertical fenestration, operable and fixed, that are unlabeled by the manufacturer have been site labeled using the default U-factor and SHGC. No credit has been given for metal frames with thermal breaks, low-emissivity coatings, gas fillings, or insulating spacers.

Air Leakage and Component Certification:

- ☒ 10. All joints and penetrations are caulked, gasketed, weather-stripped, or otherwise sealed.
- ☒ 11. Windows, doors, and skylights certified as meeting leakage requirements.
- ☒ 12. Component R-values & U-factors labeled as certified.
- ☒ 13. 'Other' components have supporting documentation for proposed U-Factors.
- ☒ 14. Building entrances that separate conditioned space from the exterior have an enclosed vestibule with all doors equipped with self-closing devices. Interior and exterior doors in the closed position are no less than 7 ft apart. Conditioned vestibules comply with the requirements for a conditioned space. Unconditioned vestibules comply with the requirements of a semheated space.
Exceptions:
 - ☐ Building entrances with revolving doors.
 - ☐ Doors not intended to be used as a building entrance.
 - ☐ Doors opening directly from a dwelling unit.
 - ☐ Doors that open directly from a space less than 3000 sq. ft. in area and is separate from the building entrance.

Section 4: Compliance Statement

Compliance Statement: The proposed envelope design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed envelope system has been designed to meet the 90.1 (2007) Standard requirements in COMcheck Version 3.8.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title

Signature

Date

Project Title:
Data filename:

Report date: 08/12/10
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2010 Indiana Energy Conservation Code

Compliance Reporting (continued)



COMcheck Software Version 3.8.0 Interior Lighting and Power Compliance Certificate

90.1 (2007) Standard

Section 1: Project Information

Project Type: **New Construction**

Project Title:

Construction Site:

Owner/Agent:

Designer/Contractor:

Section 2: Interior Lighting and Power Calculation

A	B Floor Area	C Allowed Watts / ft ²	D Allowed Watts
Automotive Facility	8587	0.9	7728
Total Allowed Watts =			7728

Section 3: Interior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Automotive Facility (8587 sq ft.)				
Incandescent 1: EC: Incandescent 75W	2	2	75	150
Linear Fluorescent: EG: 48" T5 HO 54W / Electronic	2	1	120	120
Linear Fluorescent: EGWM: 48" T5 HO 54W / Electronic	2	1	120	120
HID: T: Metal Halide 150W / Pulse start	1	3	185	495
Linear Fluorescent: HB2: 48" T5 HO 54W / Electronic	2	4	120	480
Linear Fluorescent: HB3-A: 48" T5 HO 54W / Electronic	2	7	120	840
Linear Fluorescent: IS: 48" T5 28W / Electronic	4	15	124	1860
Linear Fluorescent: IS2: 48" T5 28W / Electronic	4	3	124	372
Linear Fluorescent: LT2: 48" T5 28W / Electronic	2	2	62	124
Linear Fluorescent: LT2: 48" T5 28W / Electronic	2	10	62	620
Linear Fluorescent: LT3: 48" T5 28W / Electronic	3	9	93	837
Linear Fluorescent: LT3D: 48" T5 28W / Electronic	3	4	93	372
Linear Fluorescent: VTWM: 48" T5 28W / Electronic	4	3	124	372
Linear Fluorescent: VT: 48" T5 28W / Electronic	4	1	124	124
Linear Fluorescent: W2: 48" T5 28W / Electronic	2	6	62	372
Linear Fluorescent: W: 48" T5 28W / Electronic	3	4	93	372
Total Proposed Watts =			7630	

Section 4: Requirements Checklist

Lighting Wattage:

- ☒ 1. Total proposed watts must be less than or equal to total allowed watts.

Allowed Watts	Proposed Watts	Complies
7728	7630	YES

- ☒ 2. Exit signs 5 Watts or less per sign.

Controls, Switching, and Wiring:

Project Title:
Data filename:

Report date: 08/12/10
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- ☒ 3. Independent manual or occupancy sensing controls for each space (remote switch with indicator allowed for safety or security).
☒ 4. Occupant sensing control in class rooms, conference/meeting rooms, and employee lunch and break rooms.

Exceptions:

- ☐ Spaces with multi-scene control; shop classrooms, laboratory classrooms, and preschool through 12th grade classrooms.

- ☒ 5. Automatic shutoff control for lighting in >5000 sq ft buildings by time-of-day device, occupant sensor, or other automatic control.

Exceptions:

- ☐ 24 hour operation lighting; patient care areas; where auto shutoff would endanger safety or security.

- ☐ 6. Master switch at entry to hotel/motel guest room.

- ☒ 7. Separate control device for display/accent lighting, case lighting, task lighting, nonvisual lighting, lighting for sale, and demonstration lighting.

- ☒ 8. Tandem wired one-lamp and three-lamp ballasted luminaires (No single-lamp ballasts).

Exceptions:

- ☐ Electronic high-frequency ballasts.

- ☐ Luminaires not on same switch.

- ☐ Recessed luminaires 10 ft. apart or surface/pendant not continuous.

- ☐ Luminaires on emergency circuits.

Voltage Drop:

- ☒ 9. Feeder conductors have been designed for a maximum voltage drop of 2 percent.

- ☒ 10. Branch circuit conductors have been designed for a maximum voltage drop of 3 percent.

Interior Lighting PASSES: Design 1% better than code.

Section 4: Compliance Statement

Compliance Statement: The proposed lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 90.1 (2007) Standard requirements in COMcheck Version 3.8.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title _____ Signature _____ Date _____

Section 5: Post Construction Compliance Statement

Record Drawings and Operating and Maintenance Manuals:

- ☐ 1. Construction documents with record drawings and operating and maintenance manuals provided to the owner.

Lighting Designer or Contractor Name _____ Signature _____ Date _____

Project Title:
Data filename:

Report date: 08/12/10
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2010 Indiana Energy Conservation Code

Compliance Reporting (continued)



COMcheck Software Version 3.8.0

Exterior Lighting Compliance Certificate

90.1 (2007) Standard

Section 1: Project Information

Project Type: **New Construction**

Project Title:

Construction Site:

Owner/Agent:

Designer/Contractor:

Section 2: Exterior Lighting Area/Surface Power Calculation

A Exterior Area/Surface	B Quantity	C Allowed Watts / Unit	D Tradable Wattage	E Allowed Watts (C x D)	F Proposed Watts
Outdoor sales area/lot	53117.82	0.5	Yes	26559	13168
Total Tradable Watts* =				26559	13168
Total Allowed Watts =				26559	
Total Allowed Supplemental Watts** =				1328	

* Wattage trade-offs are only allowed between tradable areas/surfaces.

** A supplemental allowance equal to 5% of total allowed wattage may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Section 3: Exterior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Outdoor sales area/lot (53117.82): Tradable Wattage				
HID 1: 'DS-1': Dual Head Pole / Metal Halide 1000W / Pulse start	2	8	1100	8800
HID 2: 'DS-1-1': Single Head Pole / Metal Halide 1000W / Pulse start	1	1	1100	1100
HID 3: 'Exist': Existing Pole / Metal Halide 1000W / Pulse start	1	2	1100	2200
HID 4: 'WM3': Wall Mounted / Metal Halide 175W / Pulse start	1	4	195	780
Compact Fluorescent 1: 'WM': Wall Mounted (EM/Egress) / Triple 4-pin 32W / Electronic	1	2	36	72
Compact Fluorescent 2: 'C1': Awning Soffit / Triple 4-pin 32W / Electronic	1	4	36	144
Compact Fluorescent 3: 'C1E': Awning Soffit (EM/Egress) / Triple 4-pin 32W / Electronic	1	2	36	72
Total Tradable Proposed Watts =				13168

Section 4: Requirements Checklist

Lighting Wattage:

- ☒ 1. Within each non-tradable area/surface, total proposed watts must be less than or equal to total allowed watts. Across all tradable areas/surfaces, total proposed watts must be less than or equal to total allowed watts.

Compliance: Passes.

Controls, Switching, and Wiring:

- ☐ 2. All exemption claims are associated with fixtures that have a control device independent of the control of the nonexempt lighting.
- ☒ 3. All lighting fixtures are controlled by a photosensor or astronomical time switch that is capable of automatically turning off the fixture when sufficient daylight is available or the lighting is not required.

Project Title:
Data filename:

Report date: 08/12/10
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Exceptions:

- ☐ Covered vehicle entrance/exit areas requiring lighting for safety, security and eye adaptation.

Exterior Lighting Efficacy:

- ☒ 4. All exterior building grounds luminaires that operate at greater than 100W have minimum efficacy of 60 lumen/watt.

Exceptions:

- ☐ Lighting that has been claimed as exempt and is identified as such in Section 3 table above.
- ☐ Lighting that is specifically designated as required by a health or life safety statute, ordinance, or regulation.
- ☐ Emergency lighting that is automatically off during normal building operation.
- ☐ Lighting that is controlled by motion sensor.

Exterior Lighting PASSES: Design 53% better than code.

Section 5: Compliance Statement

Compliance Statement: The proposed exterior lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 90.1 (2007) Standard requirements in COMcheck Version 3.8.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title: _____ Signature: _____ Date: _____

Project Title:
Data filename:

Report date: 08/12/10
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2010 Indiana Energy Conservation Code

Compliance Reporting (continued)



COMcheck Software Version 3.8.0 Mechanical Compliance Certificate

90.1 (2007) Standard

Section 1: Project Information

Project Type: **New Construction**

Project Title:

Construction Site:

Owner/Agent:

Designer/Contractor:

Section 2: General Information

Building Location (for weather data):

Climate Zone: **5a**

Section 3: Mechanical Systems List

Quantity System Type & Description

1	Finance Office Heating: Central Furnace, Gas, Capacity 56 kBtu/h, Efficiency: 81.00% E1 / Cooling: Rooftop Package Unit, Capacity 24 kBtu/h, Efficiency: 14.00 SEER, Air-Cooled Condenser / Single Zone
1	Sales Office Heating: Central Furnace, Gas, Capacity 113 kBtu/h, Efficiency: 81.00% E1 / Cooling: Rooftop Package Unit, Capacity 48 kBtu/h, Efficiency: 14.80 SEER, Air-Cooled Condenser / Single Zone
1	Service Heating: Central Furnace, Gas, Capacity 56 kBtu/h, Efficiency: 81.00% E1 / Cooling: Rooftop Package Unit, Capacity 24 kBtu/h, Efficiency: 14.00 SEER, Air-Cooled Condenser / Single Zone
1	Service Garage Heating: Other, Gas, Capacity 450 kBtu/h / Single Zone

Section 4: Requirements Checklist

Requirements Specific To: Finance Office :

- ☒ 1. Equipment minimum efficiency: Central Furnace (Gas): 80.0 % E1 (or 78% AFUE)
- ☒ 2. Equipment minimum efficiency: Rooftop Package Unit: 13.0 SEER

Requirements Specific To: Sales Office :

- ☒ 1. Equipment minimum efficiency: Central Furnace (Gas): 80.0 % E1 (or 78% AFUE)
- ☒ 2. Equipment minimum efficiency: Rooftop Package Unit: 13.0 SEER

Requirements Specific To: Service :

- ☒ 1. Equipment minimum efficiency: Central Furnace (Gas): 80.0 % E1 (or 78% AFUE)
- ☒ 2. Equipment minimum efficiency: Rooftop Package Unit: 13.0 SEER

Requirements Specific To: Service Garage :

None

Generic Requirements: Must be met by all systems to which the requirement is applicable:

- ☒ 1. Load calculations per ASHRAE Fundamentals
- ☒ 2. Automatic Controls: Setback to 55°F (heat) and 55°F (cool), 7-day clock, 2-hour occupant override, 10-hour backup
 - ☒ Exception: Continuously operating zones
- ☒ 3. Hot water pipe insulation: 1 in. for pipes <1.5 in. and 2 in. for pipes >1.5 in.
Chilled water/refrigerant/steam pipe insulation: 1 in. for pipes <1.5 in. and 1.5 in. for pipes >1.5 in.
Steam pipe insulation: 1.5 in. for pipes <1.5 in. and 3 in. for pipes >1.5 in.
 - ☒ Exception: Piping within HVAC equipment.

Project Title: Report date: 08/12/10
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- ☒ Exception: Fluid temperatures between 60 and 105°F.
- ☒ Exception: Fluid not heated or cooled.
- ☒ Exception: Runouts <4 ft in length.
- ☒ Exception: Pipe unions in heating systems.
- ☒ 4. Thermostatic controls have 5°F deadband
 - ☒ Exception: Thermostats requiring manual changeover between heating and cooling
 - ☒ Exception: Special occupancy or special applications where wide temperature ranges are not acceptable and are approved by the authority having jurisdiction.
- ☒ 5. Demand control ventilation (DCV) present for high design occupancy areas (>40 person/1000 ft² in spaces >500 ft²) and served by systems with any one of 1) an air-side economizer; 2) automatic modulating control of the outdoor air damper; or 3) a design outdoor airflow greater than 3000 cfm.
 - ☒ Exception: Systems with heat recovery.
 - ☒ Exception: Multiple zone systems without DDC of individual zones communicating with a central control panel.
 - ☒ Exception: Systems with a design outdoor airflow less than 1200 cfm.
 - ☒ Exception: Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1200 cfm.
- ☒ 6. Where separate thermostats are used for heating and cooling, acceptable measures are used to prevent simultaneous heating and cooling
- ☒ 7. Stair and elevator shaft vents are equipped with motorized dampers
 - ☒ Exception: Ventilation systems serving unconditioned spaces.
- ☒ 8. Gravity (non-motorized) dampers are acceptable in buildings less than three stories in height above grade.
 - ☒ Exception: Measures used to prevent simultaneous humidification and dehumidification
 - ☒ Exception: Desiccant systems and systems for uses requiring specific humidity levels (approval required)
- ☒ 9. Automatic controls for freeze protection systems present
- ☒ 10. Duct, plenum, and piping insulation surfaces suitably protected from weather, moisture, or likely damage
- ☒ 11. Duct Sealing:
 - a) Pressure sensitive tape is not used as the primary sealant.
 - b) longitudinal and transverse seams for ducts in unconditioned spaces.
 - c) longitudinal and transverse seams and duct seal penetrations for ducts outside the building.
 - d) transverse seams on buried ducts
- ☒ 12. Motorized, automatic shaft dampers required on exhaust and outdoor air supply openings
 - ☒ Exception: Gravity dampers acceptable in buildings <3 stories
 - ☒ Exception: Gravity dampers acceptable in systems with outside or exhaust air flow rates less than 300 cfm where dampers are interlocked with fan
 - ☒ Exception: Gravity (non-motorized) dampers are acceptable in systems with a design outside air intake or exhaust capacity of 300 cfm (0.40 L/s) or less.
- ☒ 13. R-4 for supply air ducts located outside the building, in ventilated attics and in unvented attic above insulated ceiling
R-19 for supply air ducts in unvented attic with roof insulation.
R-3.5 for return air ducts in unconditioned and underground spaces
- ☒ 14. Humidistat controls prevent reheating, recooling, and mixing of mechanically heated air with mechanically cooled air
 - ☒ Exception: Capability to first reduce flow rate.
 - ☒ Exception: Cooling capacity <80 kBtu/h and capability to unload cooling equipment.
 - ☒ Exception: Cooling capacity <40 kBtu/h.
 - ☒ Exception: Right humidity requirements.
 - ☒ Exception: Site-recovered or site solar energy sources or.
 - ☒ Exception: Use of a desiccant system.
- ☒ 15. Exhaust air heat recovery installed for systems 5,000 cfm or greater with more than 70% outside air fraction or specifically exempted
 - ☒ Exception: Laboratory fume hood systems with a total exhaust rate of 15,000 cfm or less.
 - ☒ Exception: Systems serving spaces that are not cooled and heated to <60°F.
 - ☒ Exception: Systems with more than 60% of the outdoor heating energy is provided from site-recovered or site solar energy.
 - ☒ Exception: Cooling systems in climates with a 1% cooling design wet bulb temperature less than 64°F.
- ☒ 16. Kitchen hoods >5,000 cfm provided with 50% makeup air that is uncooled and heated to no more than 60°F unless specifically exempted

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- ☒ Exception: Where hoods are used to exhaust ventilation air that would otherwise exfiltrate or be exhausted by other fan systems.
- ☒ Exception: Certified grease extractor hoods that require a face velocity no >60 fpm.
- ☒ 17. Buildings with fume hood systems must have variable air volume hood design:
 - exhaust heat recovery, or separate makeup air supply meeting the following:
 - a) 75% make up air quantity, and for
 - b) within 2°F of room temperature and/or
 - c) no humidification
 - d) no simultaneous heating and cooling

Section 5: Compliance Statement

Compliance Statement: The proposed mechanical design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 90.1 (2007) Standard requirements in COMcheck Version 3.8.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title Signature Date

Section 6: Post Construction Compliance Statement

- ☒ HVAC record drawings of the actual installation and performance data for each equipment provided to the owner within 90 days after system acceptance.
 - ☒ HVAC O&M documents for all mechanical equipment and system provided to the owner within 90 days after system acceptance.
 - ☒ Written HVAC balancing report provided to the owner.
- The above post construction requirements have been completed.

Principal Mechanical Designer Name Signature Date

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2010 Indiana Energy Conservation Code

To explain this new regulation and its use for real projects, each of the following topics will be covered—

- **Applicability:** to which projects will this apply?
- **General Administrative Rules provisions**
- **History:** how did we get here? And why did this change?
- **Enforcement:** what did we have before and what will we have now?
- **Specific Requirements—**
 - Indiana Amendments*
 - Climate Zones*
 - Building Envelope*
 - HVAC*
 - Water Heating*
 - Power*
 - Lighting*
 - Other Equipment*
- **Compliance Reporting**
- **Summary**

2010 Indiana Energy Conservation Code

Summary

The new 2010 Indiana Energy Conservation Code brings Indiana into compliance with EAct and completely up-to-date with most other States. Many States are using the 2006 International Energy Conservation Code as the basis of their rules, and that Code allows for compliance with ASHRAE 90.1-2004, as one option. So our use of ASHRAE 90.1-2007 actually moves us slightly forward. The 2009 International Energy Conservation Code allows for compliance with ASHRAE 90.1-2007, but that Code has not yet been widely adopted.

According to the US DOE, Alaska, Connecticut, Delaware, Georgia, Idaho, Illinois, Iowa, Kentucky, Maryland, Montana, New Hampshire, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, Utah, and Virginia have all adopted the 2009 International Energy Conservation Code; several other states, including Indiana, use ASHRAE 90.1-2007.

2010 Indiana Energy Conservation Code

Summary

This is a major change from the 1992 CABO Energy Code that we were using in Indiana, but it will only matter if there is some reasonable level of enforcement. As licensed design practitioners, we must comply with these rules and we will.

The most significant issues are increased envelope performance requirements (reduced infiltration/exfiltration, increased insulation, and greatly increased glass performance), somewhat more stringent mechanical equipment efficiencies, and greatly increased lighting requirements. The latter may be the most significant of all.

2010 Indiana Energy Conservation Code

Sources

ASHRAE 90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings

Title 675 Fire Prevention and Building Safety Commission, Final Rule, LSA Document #09-388(F)

90.1 User's Manual, ANSI/ASHRAE/IESNA Standard 90.1-2007 Energy Standard for Buildings
Except Low-Rise Residential Buildings

The Lighting Handbook, 9th Edition, Illuminating Engineering Society

The Lighting Handbook, 10th Edition, Illuminating Engineering Society

AGC Glass, Cardinal Glass, Guardian Glass, PPG Glass, and Viracon Glass
Knauf Insulation

Thank you

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